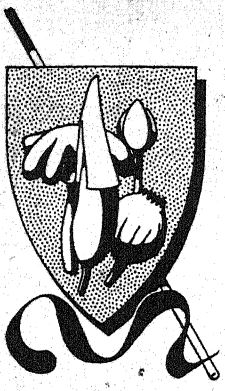

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HEPATICAE OF MINNESOTA

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The aim of this work is to present a complete list of the Hepaticae which have been found in Minnesota. A critical examination has been made of the specimens in the herbaria of the University of Minnesota, University of Wisconsin, Yale University, New York Botanical Garden, and the Herbarium of the Sullivant Moss Society. The personal collections of J. M. Holzinger of Winona, Minnesota, and those of the writer, who has collected over a period of fifteen years in the northeastern part of the state, are likewise included. The Holzinger specimens are now in the Herbarium of the University of Minnesota, with duplicates in the Herbarium of the Sullivant Moss Society.[1]

It is now possible to present a fairly complete catalogue of the species of Hepaticae for Minnesota. With the exception of the specimens in the Yale University Herbarium which have been named by Dr. A. W. Evans, the specimens in this report have been reëxamined to verify the species or to correct mistakes. It was thought that such a presentation would be helpful to students of ecology, taxonomy and geographical distribution, and would stimulate a greater interest in this group of plants, particularly in those counties in which no bryological survey has been made. The result of an intensive survey, such as Holzinger made in the lower Mississippi River Counties,

* The late Dr. G. H. Conklin prepared this paper for one of the Minnesota publications more than a decade ago, but because of insufficient funds, it was not published. With a generous expenditure of time, Dr. Margaret Fulford has condensed the report for publication here, and has revised the nomenclature in accordance with A. W. Evans' "List of Hepaticae found in the United States, Canada, and Arctic America" (THE BRYOLOGIST 40: 133–138. 1940). For an account of Dr. Conklin's life and work, the reader is referred to Dr. Fulford's paper in THE BRYOLOGIST 41: 1–4. 1941. —W. C. S.

[1] Dr. Conklin's collections are now in the Herbarium of the Sullivant Moss Society.

Conklin in the Duluth-Superior District, Rev. Jas. Hansen in Stearns County, and the earlier botanists along the International Border, shows what a similar survey of other regions might be expected to produce in new species and extensions of ranges. Minnesota offers a wide variety of habitats and is a meeting place of species from the north, south, east and west. A number of the species may be regarded as glacial relicts, notably *Asterella saccata*, *A. Ludwigii*, *Tritomaria scitula* and *Lophozia grandiretis*. Then too, a portion of Minnesota includes and borders the unglaciated Wisconsin area. In addition, the limestone outcrops in the southeastern counties offer habitats for many species limited in their requirements.

HISTORY: The first collection of hepatics was reported in 1875 by I. A. Lapham in his catalogue of the plants of Minnesota published under the auspices of the State Horticultural Society (1). Three species are here given, namely: *Marchantia polymorpha*, *Trichocolea tomentella* and *Bazzania trilobata*. No locality or dates are given in the report. It is a curious fact that *Trichocolea tomentella* has not been reported since by later collectors. The species is rather common in Wisconsin in Douglas, Oneida, Adams, Iron, Barron and Ashland Counties.

In 1887, and subsequent years, N. H. Winchell, state geologist, included in the publications of the Geological and Natural History Survey of Minnesota, botanical reports of various years under the title *Botanical Series*. One of the earlier of these (3) reported nine species of Hepaticae collected by J. C. Arthur, L. H. Bailey and E. W. D. Holway at Lake Vermilion and St. Louis River in St. Louis Co., namely: *Conocephalum conicum*, *Marchantia polymorpha*, *Blepharostoma trichophyllum*, *Ptilidium ciliare*, *Gymnocolea inflata* (as *Jungermannia*), *Jamesoniella autumnalis* (as *J. Schraderi*), *Frullania eboracensis*, *Porella platyphylla* and *Pellia epiphylla*. These specimens are in the herbaria of the New York Botanical Garden and the University of Minnesota. *Ptilidium ciliare* of this report, No. A-70, has not been found. *P. ciliare*, same date and locality, Nos. 29-A, 44-A is *P. pulcherrimum*.

From 1890 to 1893 J. M. Holzinger collected extensively in Winona, Washington and Chisago Counties in Minnesota, and to some extent in Trempealeau and Buffalo Counties in Wisconsin. Twenty-five species were reported (6). One of these, *Anthoceros laevis*, was found only in Wisconsin. *Reboulia hemisphaerica*, *Frullania eboracensis*,

and *Porella platyphylla* were reported from both Wisconsin and Minnesota. The remaining species of the list from Minnesota are *Blasia pusilla, Chiloscyphus polyanthus, Conocephalum conicum, Frullania riparia* (as *F. aeolotis*), *F. Brittoniae* (as *F. dilatata*), *Geocalyx graveolens, Lophozia excisa* (as *Jungermannia*), *L. incisa* (as *Jungermannia*), *L. ventricosa* (as *Jungermannia*), *Jamesoniella autumnalis* (as *Jungermannia Schraderi*), *Calypogeia Trichomanis* (as *Kantia*), *Lophocolea heterophylla, L. minor, Mannia fragrans* (as *Grimaldia barbifrons*), *Marchantia polymorpha, Plectocolea crenulata* (as *Nardia*), *Preissia quadrata, Ptilidium ciliare, Ricciocarpus natans* (as *R. natans* and *Riccia lutescens*). Omitting the Wisconsin plants and combinations, 21 species remain. L. M. Underwood named the collection.

In 1891 L. S. Cheney and F. F. Wood collected in St. Louis and Cook Counties (4). The following species from this trip are to be found in the University of Wisconsin and New York Botanical Garden Herbaria: *Ricciocarpus natans, Preissia quadrata, Riccardia latifrons, Pellia epiphylla, P. Neesiana* (as *P. endiviaefolia*), *Jamesoniella autumnalis, Tritomaria quinquedentata* (as *Lophozia*), *T. exsectiformis* (as *Scapania exsecta*), *Plagiochila asplenioides, Isopaches Hellerianus* (as *Sphenolobus exsectus*), *Sphenolobus minutus* (as *Diplophyllum Dicksoni*), *Lophocolea heterophylla, Cephalozia media, Bazzania trilobata, Lepidozia reptans, Ptilidium pulcherrimum* (as *P. ciliare*), *Blepharostoma trichophyllum* (also contains *Leiocolea heterocolpa*), *Scapania nemorosa, Radula complanata, Porella platyphylla* and *Frullania eboracensis.*

In 1895, September 1 to 10, Conway MacMillan collected 6 species of hepatics in Cook County, along the International Border, between Saganaya and South Lakes, on the Portage Trails of the Dawson Conner Road from Lake Superior to Winnepeg (5). The species were *Conocephalum conicum, Chiloscyphus rivularis, Barbilophozia barbata* (as *Lophozia*), *Jamesoniella autumnalis, Radula complanata, Ptilidium ciliare.* The following year he collected a few species on Minnesota Island, Lake of the Woods.

In 1897 J. M. Holzinger made his first trip to the International Border from Ely to Lake Superior, collecting at Prairie Portage, Basswood Lake, Sucker Lake, Fall Lake, Gunflint Lake, Grand Portage, Grand Portage Island, Safety Island and U. S. Peninsula. He collected 16 species which were named and reported on by A. W. Evans (7), namely: *Jamesoniella autumnalis, Bazzania trilobata, Ble-*

pharostoma trichophyllum, Cephalozia catenulata, C. media, Frullania eboracensis, Barbilophozia barbata (as *Lophozia*), *Tritomaria quinquedentata* (as *Lophozia*), *Lophozia ventricosa, Lejeunea cavifolia, Lepidozia reptans, Plagiochila asplenioides, Porella platyphylla, Ptilidium ciliare, Radula complanata, Scapaniella glaucocephala.* The specimens listed as *P. ciliare* collected at Fall Lake and Safety Island are *P. pulcherrimum.*

In 1901 Messrs. MacMillan, Lyon and Brand collected hepatics from northeastern Minnesota in Lake and Cook Counties. The next year J. M. Holzinger also made collections in Cook County, in the vicinity of Grand Marais, and along the lake shore at Grand Portage. These two collections were named by A. W. Evans and the 33 species reported together (8). This notable collection added 16 hitherto unrecorded species for the state and 3 for the United States. *Harpanthus Flotowianus*, No. 15 of this report was later corrected to *H. scutatus* (10), and *Porella rivularis*, No. 3, to *P. platyphylla* (9). No. 19, *Cephalozia divaricata* (Grand Marais) is *Cephaloziella Hampeana* (Det. Douin). No. 25, *Ptilidium ciliare* of the report, includes both *P. ciliare* and *P. pulcherrimum.* The specimens from Mt. Josephine, Grand Marais and Stair Portage, No. 184, are *P. ciliare.* The ones from Grand Portage Island, Old Iron Trail, Reves Lake, No. 27, Portage, North and South Lakes, No. 142, Grand Marais No. 25-26, Gunflint Trail, No. 53-51, and Hat Point are *P. pulcherrimum.* No. 29, *Porella platyphylla*, has since been corrected to *P. platyphylloidea* (9). The 33 species include the following: *Marsupella emarginata, Jamesoniella autumnalis, Barbilophozia barbata* (as *Lophozia*), *Leiocolea heterocolpa* (as *Lophozia*), *L. Rutheana* (as *Lophozia*), *Tritomaria quinquedentata* (as *Lophozia*), *T. exsectiformis* (as *Sphenolobus*), *T. exsecta* (as *Sphenolobus*), *Isopaches Hellerianus* (as *Sphenolobus*), *Anastrophyllum Michauxii* (as *Sphenolobus*), *Lophozia incisa, L. ventricosa, Plagiochila asplenioides, Lophocolea heterophylla, Harpanthus scutatus, Cephalozia bicuspidata, C. catenulata, Cladopodiella fluitans* (as *Cephalozia*), *Nowellia curvifolia* (as *Cephalozia*), *Cephaloziella Hampeana, Odontoschisma Macounii, Bazzania trilobata, Lepidozia reptans, Blepharostoma trichophyllum, Ptilidium ciliare, P. pulcherrimum, Scapania subalpina, S. undulata, Radula complanata, Porella platyphylloidea, P. platyphylla* (No. 42), *Frullania eboracensis, F. Oakesiana.*

From 1906 to 1913, the writer collected extensively in the Duluth-

Superior Region of Wisconsin and Minnesota. In a preliminary report on the Hepaticae of Wisconsin and Minnesota (11), 66 species were reported for Minnesota. Since 1914, 37 additional species have been found in the district, (12), making a total of 103 species for St. Louis, Lake and Cook Counties. The species from Minnesota, published in 1914 (11) were: *Conocephalum conicum, Preissia quadrata, Marchantia polymorpha, Riccardia latifrons, R. multifida, R. palmata, R. pinguis, Blasia pusilla, Pellia epiphylla, P. Neesiana, Chiloscyphus pallescens, C. polyanthus, Geocalyx graveolens, Harpanthus scutatus, Jamesoniella autumnalis, Jungermannia lanceolata, J. pumila, J. sphaerocarpa, Lophocolea heterophylla, L. minor, Lophozia alpestris, L. excisa, L. incisa, L. longidens, L. ventricosa, Orthocaulis attenuatus,* (as *Lophozia*), *Barbilophozia barbata* (as *Lophozia*), *Isopaches bicrenata* (as *Lophozia*), *I. Helleranus* (as *Sphenolobus*), *Leiocolea heterocolpa* (as *Lophozia*), *L. Gilmani* (as *Lophozia Kaurini*), *Tritomaria quinquedentata* (as *Lophozia*), *T. exsectiformis* (as *Sphenolobus*), *T. exsecta* (as *Sphenolobus*), *Anastrophyllum Michauxii* (as *Sphenolobus*), *Plagiochila asplenioides, Cephaloziella myriantha, Bazzania trilobata, Calypogeia Neesiana, Cephalozia bicuspidata, C. catenuata, C. connivens, C. media, C. pleniceps, Nowellia curvifolia, Lepidozia reptans, Blepharostoma trichophyllum, Ptilidium ciliare, P. pulcherrimum, Scapania apiculata, S. nemorosa, S. undulata, Scapaniella glaucocephala, Radula complanata, R. obconica, Porella pinnata, P. platyphylla, Frullania Asagrayana, F. eboracensis, F. Bolanderi, F. inflata, F. Oakesiana, F. Selwyniana, Lejeunea cavifolia.*

The additional species collected by the writer in St. Louis, Lake and Cook Counties since 1914 (12), are: *Mannia pilosa* (as *Grimaldia*), *Asterella Ludwigii, Pellia Fabroniana, Chiloscyphus fragilis, Jungermannia Schiffneri, Leiocolea badensis* (as *Lophozia*), *L. Rutheana* (as *Lophozia*), *Lophozia grandiretis, L. longiflora, L. marchica, L. porphyroleuca* (including *L. guttulata*), *Marsupella emarginata, Mylia anomala, Plectocolea hyalina, Sphenolobus minutus, Tritomaria scitula* (as *Sphenolobus*), *Cephaloziella byssacea, C. elachista, C. Hampeana, C. rubella, C. Sullivantii, Calypogeia sphagnicola, C. succica, C. Trichomanis, Cephalozia Macounii, Odontoschisma Macounii, Diplophyllum apiculatum, Scapania gymnostomophila* (as *Diplophyllum*), *S. irrigua, S. mucronata, S. paludicola, S. subalpina, Porella platyphylloidea, Frullania Brittoniae, Cololejeunea Biddlecomiae.*

The species here reported which have not been found by the writer

in Carlton, St. Louis, Lake and Cook Counties are 16, namely: *Riccia fluitans, Ricciocarpus natans, Mannia fragrans, M. rupestris, Reboulia hemisphaerica, Asterella saccata, Metzgeria conjugata, Chiloscyphus, Gymnocolea inflata, Plectocolea crenulata, Cladopodiella fluitans, Trichocolea tomentella, Frullania riparia, Notothylas orbicularis, Anthoceros Macounii, A. punctatus.*

Of these 16, there are a number which come well within the range of the district and undoubtedly will be found, namely: *Riccia fluitans, Ricciocarpus natans, Chiloscyphus rivularis, Gymnocolea inflata, Cladopodiella fluitans,* and *Trichocolea tomentella.* The distinctly limestone hepatics, *Plectocolea crenulata, Frullania riparia, Metzgeria conjugata* and *Reboulia hemisphaerica* are of extremely doubtful occurrence.

The detailed list which follows includes 117 species, 4 of which belong to the Anthocerotales, 11 to the Marchantiales, 9 to the Metzgerineae, and 93 to the Jungermannineae.

The following abbreviations are used to designate herbaria and collectors: (UM) University of Minnesota; (UW) University of Wisconsin; (NY) New York Botanical Garden; (SMS) Sullivant Moss Society Hepatic Herbarium; (YU) Yale University; *Holzinger*, J. M. Holzinger of Winona, Minn.; *Cheney*, L. S. Cheney of Barron, Wisconsin; *Conklin*, George H. Conklin of Superior, Wisconsin; *MacM. L. & B.*, Messrs. MacMillan, Lyon, and Brand, University of Minnesota; *A. B. & H.*, J. C. Arthur, L. H. Bailey, E. W. D. Holway, University of Minnesota; *AWE*, A. W. Evans of Yale University, Connecticut.

To avoid repetition, the specimens following a collector's name or locality, unless otherwise given, belong to the previously named collector or locality or date. A chronological order of the various collections is attempted. The genera are arranged according to the "List of Hepaticae found in the United States, Canada and Arctic America," by A. W. Evans, THE BRYOLOGIST **43**: 133–138. 1940. The herbaria in which the specimens are located are in most instances given. A few of the specimens in the earlier reports have not been examined. Where no herbarium is given the specimens connot be located.

Grateful acknowledgement is here made to those having charge of the herbaria, and to Miss C. C. Haynes, Dr. M. A. Howe, Dr. A. W. Evans, and Dr. C. E. Allen for their valuable assistance. Dr. C. O.

Rosendahl, of the Botanical Department of the University of Minnesota, revised the bibliography.

PTILIDIACEAE

PTILIDIUM CILIARE (L.) Nees. Vermilion Lake, St. Louis Co., July, 1886, *A. B. & H.* 70A (this number is not available for study) 29A, 44A, same place and date, are referred to *P. pulcherrimum;* Homer, Winona Co., July, 1890, *Holzinger* (UM); Marine Mills, Washington Co., July, 1890, 21 (UM); Winona Bluffs, Winona Co., May, 1894 (UM); International Boundary, Cook Co., Sept., 1895, *MacMillan* 55; Sucker Lake, Camp IV, Cook Co., June, 1897, *Holzinger* (UM); U. S. Peninsula, Basswood Lake, Lake Co., June, 1897 (UM); Portage to Basswood Lake, Camp IV, Lake Co., June, 1897 (UM); Safety Island, Saganaya, Camp VIII, Cook Co., June, 1897 (UM); Stair Portage, Aug., 1901, *MacM. L & B.* 184 (UM & YU); Grand Marais, July to Aug., 1902, *Holzinger* (UM & YU); Carlton, Carlton Co., Sept., 1909, *Conklin* 690 (SMS & YU); Lutsen, Cook Co., Sept., 1911, 1198 (SMS); Nopeming, St. Louis Co., May, 1922, 1580 (SMS); Oneota, Duluth, Sept., 1923, 1866pp (SMS); Hungry Jack Lake, Cook Co., Sept., 1924, 2341 (SMS); Pigeon River, Sept., 1925, 2525, 3034 (SMS).

PTILIDIUM PULCHERRIMUM (Web.) Hampe. Lake Vermilion, St. Louis Co., June, 1886, *A. B. & H.* 29A, 44a (NY); Homer Winona Co., June, July, 1890, *Holzinger* 4 (UM); Winona, June, 1890, 4 (NY); Marine Mills, Washington Co., July, 1890 (UM); Indian Reservation, Pigeon River, Cook Co., June, July, 1891, *F. F. Wood* 100 (NY); Indian Reservation, Pigeon River, July, 1891, *Cheney* 4 (NY); Grand Marais, June, 1891, 20 (UW); Minnesota Island, Leach Lake, Cass Co., July, 1896, *Conway MacMillan* (UM); Fall Lake, Lake Co., June, 1897, *Holzinger* (UM & YU); Safety Island, Cook Co., June, 1897 (UM); Grand Marais, Aug., 1901, *MacM. L. & B.* 25, 26, 27 (UM & YU); Gunflint Trail, Aug., 1901, 51, 53 (UM & YU); Portage, North & South Lakes, Aug., 1901, 142 (UM & YU); Reve Lake, Aug., 1901, 175 (UM & YU); Gunflint Trail, July, 1902, *Holzinger* (UM & YU); Grand Portage Island, Aug., 1902, (UM & YU); Old Iron Trail, Aug., 1902 (UM); Mt. Josephine, Aug., 1902, (UM); Hat Point, Aug., 1902 (UM & YU); Grand Marais, July to Aug., 1902, (UM); Albert, Carlton Co., Sept., 1905, *Conklin* 1020 (SMS); Lester Park, Duluth, St. Louis Co., Oct., 1906, 1021 (SMS); Knife River, Lake Co., Aug., 1909, 804 (SMS); Oneota, Duluth, St. Louis Co., Aug., 1909, 792 (SMS); Carlton, Carlton Co., Sept., 1909, 622 (SMS); French River, St. Louis Co., Oct., 1910 (SMS); Collegeville, Stearns Co., July, 1910, *Rev. Jas. Hansen* (15) (SMS); Spirit Lake, Duluth, St. Louis Co., Aug., 1911, *Conklin* 1641 (SMS); Lutsen, Cook Co., Sept., 1911, 1153 (SMS); Red Wing, Goodhue Co., Aug., 1919, Sept., 1919, *Holzinger* 16 (YU); same location, Aug., 1919, 5, 6, 16, 17, 18, 22 (UM); Lewiston, Winona Co., April, 1920 (UM); Hungry Jack Lake, Cook Co., July, 1924, *Conklin* 2273 (SMS); same location, Aug., 1924, 2336 (SMS); Two Island River, Lake Co., May, 1925, 2616 (SMS); Pigeon River, Cook Co., Sept., 1925, 2580 (SMS); Grand Marais, Aug., 1926, 2658 (SMS); Hat Point, Aug., 1927, 3116 (SMS); Pine Island, Lake Vermilion, St. Louis Co., Sept., 1927, 3072 (SMS).

BLEPHAROSTOMA TRICHOPHYLLUM (L.) Dumort. St. Louis River, St. Louis Co., July, 1886, *A. B. & H.* 126A (UM); Grand Marais, Cook Co., June, 1891, *Cheney* 81 (UW & NY); Pipestone Rapids, Basswood Lake, Lake Co., June, 1897, *Holzinger* (UM); Gunflint Trail, Cook Co., *MacM. L. & B.* Aug., 1901 (UM); Portage, between North & South Lakes, 1901, *Holzinger* (UM); Gunflint Trail, July, 1902 (UM); Grand Marais, July to Aug., 1902 (UM); Old Iron Trail, July, 1902 (UM); Little Devils Track Trail, July, 1902 (UM); Grand Portage Island, Aug., 1902 (UM); Oneota, Duluth, St. Louis Co., July, 1909, *Conklin* 778, 992 (SMS); Knife River, Lake Co., Aug., 1909, 659 (SMS); French River, St. Louis Co., Oct., 1909, 913 (SMS); Fairmount Park,

Duluth, July, 1911, 1010 (SMS); Spirit Lake, Aug., 1911, 1633 (SMS); Lutsen, Cook Co., Sept., 1911, 1776, 1179 (SMS); Briery, Pike Lake Road, St. Louis Co., July, 1912, 1598 (SMS); Nopeming, June, 1916, 1357 (SMS); same location, Aug., 1922, 1226 (SMS); Hungry Jack Lake, Cook Co., July, 1924, 2265 (SMS); Moss Lake, Hungry Jack Region, Aug., 1924, 2324 (SMS); Duncan Lake, July, 1924, 2269 (SMS); Beaver Dam Trail to Hungry Jack Lake, Sept., 1924, 2322 (SMS); Cascade River, Sept., 1924, 2346 (SMS); Two Island River, Lake Co., May, 1925, 2606, 2478, 2508 (SMS); Pigeon River, Cook Co., Sept., 1925, 2587, 2588 (SMS); Grand Marais, July, 1926, 2681, 3012 (SMS); Arrowhead River, Sept., 1926, 2543 (SMS); Hat Point, Grand Portage, Aug., 1927, 3123 (SMS).

TRICHOCOLEA TOMENTELLA (Ehrh.) Dumort. Listed from Minnesota by *I. A. Lapham* without locality or date in 1875.

LEPIDOZIACEAE

BAZZANIA TRILOBATA (L.) S. F. Gray. This species was reported by *I. A. Lapham* without locality or date in 1875; Fond du Lac, St. Louis Co., June, 1891, *F. F. Wood* 120 (NY); Rock Break, 1890, 1893, *Holzinger* (UM); U. S. Peninsula, Basswood Lake, Lake Co., June, 1897, *Holzinger* (UM); 7 miles from Ely, Lake Co., June, 1897, (UM); Pipestone Rapids, Camp II, June, 1897 (UM); Basswood Lake, Camp II, June, 1897 (UM); Fall Lake, Kawasatchong Falls, June, 1897 (UM); Gunflint Lake, Cook Co., Aug., 1901, *MacM. L & B.* (UM & YU); Grand Marais, Aug., 1901 (UM & YU); Mt. Josephine, Grand Portage, Aug., 1902, *Holzinger* (UM); Grand Marais, July to Aug., 1902, 24 (UM & NY); Gunflint Trail, July, 1902 (UM); Old Iron Trail, July, 1902, 211 (UM); Hat Point, Aug., 1902 (UM); Grand Portage, Aug., 1902 (UM); Albert, Carlton Co., Sept., 1905, *Conklin* 317 (SMS); Knife River, Lake Co., Aug., 1909, 840, 852 (SMS); French River, St. Louis Co., Oct., 1909, 646 (SMS); Lutsen, Cook Co., Sept., 1911, 1108, 1167 (SMS); Nopeming, St. Louis Co., Nov., 1916, 1402 (SMS); same location, May, 1922, 1756 (SMS); Hat Point, Grand Portage, Cook Co., Aug., 1927, 3115 (SMS).

LEPIDOZIA REPTANS (L.) Dumort. Grand Marais, Cook Co., June 24, 1891, *Cheney* (UW); Basswood Lake, Lake Co., June, 1897, *Holzinger* (UM); Lake Saganaya, Cook Co., June, 1897 (UM); Pipestone Rapids, Lake Co., June, 1897 (UM); Grand Portage Island, Cook Co., June, 1897, 111 (UM); Camp VIII, Safety Island, June, 1897 (UM); U. S. Peninsula, Lake Co., 1897 (UM & YU); Grand Marais, Cook Co., 1901, *MacM. L. & B.* 183pp (YU); Portage, between North & South Lakes, 1901, 143pp (YU); Stair Portage, 1901, 160 (YU); Grand Marais, July to Aug., 1902, *Holzinger* (UM); Little Devils Track Trail, July, 1902 (UM & YU); Gunflint Trail, July, 1902 (UM); Grand Portage Island, Aug., 1902 (UM & YU); Hat Point, Aug., 1902 (UM & YU); Spirit Lake, Duluth, St. Louis Co., Oct., 1907, *Conklin* 150 (SMS); Chester Creek, May, 1907, 416, 420 (SMS); Knife River, Lake Co., Aug., 1909, 859, 874 (SMS); French River, St. Louis Co., Oct., 1909, 709 (SMS); Lutsen, Cook Co., Sept., 1911, 1173 (SMS); Nopeming, St. Louis Co., Nov., 1916, 1383 (SMS & YU); Hungry Jack Lake, Cook Co., July, 1924, 2268 (SMS); Duncan Lake, Hungry Jack Lake, July, 1924, 2256 (SMS); Moss Lake, 2299 (SMS); Beaver Dam, Hungry Jack Trail, Sept., 1924, 2301 (SMS); Two Island River, Lake Co., May, 1925, 2615 (SMS); Pigeon River, Cook Co., Sept., 1925, 2529, 2592 (SMS); Grand Marais, Aug., 1926, 2657 (SMS); Pine Island, Lake Vermilion, St. Louis Co., Sept., 1927, 3071 (SMS).

CALYPOGEIACEAE

CALYPOGEIA NEESIANA (Massal. & Carest.) K. Müll. Lutsen, Cook Co., Sept., 1911, *Conklin* 1128, 1132 (C. C. Haynes exsiccatae) (SMS & YU); Briery, Pike Lake Road, St. Louis Co., July, 1912, 1659 (SMS); Hungry Jack Lake, Cook Co., Sept., 1924, 2332, 2333 (SMS); Pigeon River, July, 1926, 3021 (SMS); same location, Aug., 1927, 3031 (SMS).

CALYPOGEIA SPHAGNICOLA (Arn. & Perss.) Warnst. & Loeske. Pigeon River, Cook Co., Aug., 1927, *Conklin* 3040 (SMS).

CALYPOGEIA SUECICA (Arn. & Press.) K. Müll. Lutsen, Cook Co., Sept., 1911, *Conklin* 1237, 2178 (SMS & YU); Hungry Jack Lake Trail, Beaver Dam, Sept., 1924, 2254, 2257 (SMS); Arrowhead River, Sept., 1925, 2546 (SMS).

CALYPOGEIA TRICHOMANIS (L.) Corda. Franconia, Chisago Co., July, 1890, *Holzinger;* Pigeon River, Cook Co., Aug., 1927, *Conklin* 3040 (SMS).

CEPHALOZIACEAE

CEPHALOZIA BICUSPIDATA (L.) Dumort. Grand Marais, Cook Co., July to Aug., 1902, *Conklin* (SMS & YU); Minnesota Point, Duluth, St. Louis Co., Sept., 1907, 335 (SMS & YU); Hungry Jack Lake, Cook Co., Sept., 1924, 2286 (SMS).

CEPHALOZIA CATENULATA (Hüben.) Spruce. Fall Lake, Kawasatchong Falls, Lake Co., Jan., 1897, *Holzinger* 4 (UM & YU); Grand Marais, Cook Co., 1901, *MacM. L. & B.* 236 (UM & YU); Lutsen, Sept., 1911, *Conklin* 1484 (SMS); Briery, Pike Lake Road, St. Louis Co., July, 1912, 1223A (SMS & YU).

CEPHALOZIA CONNIVENS (Dicks.) Lindb. Lutsen, Cook Co., Sept., 1911, *Conklin* 1166 (SMS); Briery, Pike Lake Road, St. Louis Co., July, 1912, 2076 (SMS); Pigeon River, Cook Co., Aug., 1927, 3038 (SMS); Pine Island, Lake Vermilion, St. Louis Co., Sept., 1927, 3069 (SMS).

CEPHALOZIA MEDIA Lindb. Grand Marais, Cook Co., July, 1891, *Cheney* 27pp (UW & UM & NY); Fall Lake, Lake Co., 1897, *Holzinger* (UM & YU); Grand Portage, Cook Co., June, 1897, *Holzinger & Arthur Elftman* 5 (UM); Little Devils Track Trail, July, 1902, *Holzinger* (UM); Grand Marais, July to Aug., 1902 (UM); Spirit Lake, Duluth, St. Louis Co., Oct., 1906, *Conklin* 386 (SMS); Minnesota Point, Duluth, Sept., 1907, 309 (SMS); Knife River, Lake Co., Aug., 1909, 860, 912 (SMS & YU); French River, St. Louis Co., Oct., 1909, 637 (SMS); Collegeville, Stearns Co., March, 1910, *Rev. Jas; Hansen* 14 (SMS); Lutsen, Cook Co., Sept., 1911, *Conklin* 1172 (SMS), Briery, Pike Lake Road, St. Louis Co., July, 1913, 1466 (SMS); Nopeming, May, 1923, 1845 (SMS); Hungry Jack Lake, Cook Co., Aug., 1924, 2319 (SMS); Beaver Dam, Hungry Jack Trail, Sept., 1924, 2320 (SMS); Arrowhead River, Sept., 1925, 2544 (SMS); Two Island River, Lake Co., May, 1925, 2596 (SMS); Pigeon River, Cook Co., Aug., 1927, 3046 (SMS).

CEPHALOZIA PLENICEPS (Aust.) Lindb. Lutsen, Cook Co., Sept., 1911, *Conklin* 1165 (SMS); Beaver Dam Trail to Hungry Jack Lake, Sept., 1924, 2289 (SMS); Hungry Jack Lake, Sept., 1924, 2288 (SMS); Pigeon River, July, 1926, 3019 (SMS); Grand Marais, Aug., 1926, 2662 (SMS); Pigeon River, Aug., 1927, 3043 (SMS); Pine Island, Lake Vermilion, St. Louis Co., Sept., 1927, 3070 (SMS).

NOWELLIA CURVIFOLIA (Dicks.) Mitt. Portage between North & South Lakes, Cook Co., Aug., 1901, *MacM. L. & B.* 140 (UM & YU); Arrow Lake, Aug., 1901, 172pp (UM); Hungry Jack Lake, Aug., 1901, 88 (UM & YU); Old Iron Trail, July, 1902, *Holzinger* (UM & YU); Little Devils Track Trail, July, 1902 (UM); Gunflint Trail, July, 1902 (UM); Albert, Carlton Co., Oct., 1907, *Conklin* 222 (SMS); Knife River, Lake Co., May, 1909, 865 (SMS); Oneota, Duluth, St. Louis Co., July, 1909, 755 (SMS); Carlton, Carlton Co., Sept., 1909, 679 (SMS); French River, St. Louis Co., Aug. to Oct., 1909, 641 (SMS); Condon Park, Duluth, Aug., 1911, 1719 (SMS); Spirit Lake, Aug., 1911, 1604½ (SMS); Lutsen, Cook Co., Sept., 1911, 1176 (SMS); Briery, Pike Lake Road, St. Louis Co., July, 1912, 1595 (SMS); Pigeon River, Cook Co., Sept., 1925, 2531 (SMS); Pine Island, Lake Vermilion, St. Louis Co., Sept., 1927, 3068 (SMS).

CLADOPODIELLA FLUITANS (Nees) Joerg. Grand Marais, Cook Co., 1901, *MacM. L. & B.*

ODONTOSCHISMA MACOUNII (Aust.) Underw. Grand Marais, Cook Co., July to Aug., 1902, *Holzinger* (UM & YU); Grand Marais, July, 1926, *Conklin*

3011, 3004 (SMS); same location, Aug., 1926, 2647 (SMS); Aug., 1927, 3023 (SMS).

CEPHALOZIELLACEAE

CEPHALOZIELLA BYSSACEA (Roth) Warnst. Grand Marais, Cook Co., July to Aug., 1902, *Holzinger* (UM); Hat Point, Aug., 1902 (UM); Chester Creek, Duluth, St. Louis Co., July, 1909, *Conklin* 884 (SMS); Lester River, Oct., 1910, 1089 (SMS); Fairmount Park, July, 1911, 2050 (SMS); Oneota, Sept., 1923, 1859 (SMS); Pigeon River, Cook Co., Sept., 1925, 2528, 2586 (SMS).

CEPHALOZIELLA ELACHISTA (Jack) Schiffn. Pigeon River, Cook Co., July, 1926, *Conklin* 3018 (SMS); same location, Aug., 1927, 3042, 3044 (SMS).

CEPHALOZIELLA HAMPEANA (Nees) Schiffn. Grand Marais, Cook Co., July to Aug., 1902, *Holzinger* (UM & YU); Mt. Josephine, Aug., 1902 (UM & YU); Hat Point, Aug., 1902 (UM); Carlton, Carlton Co., Sept., 1909, *Conklin* 688, 689 (SMS); Oneota, Duluth, St. Louis Co., Aug., 1909, 701, 941, 1263 (SMS); Thompson, Carlton Co., Oct., 1910, 1568 (SMS); Nopeming, St. Louis Co., May, 1921, 1259 (SMS); Pigeon River, Cook Co., Sept., 1925, 2500 (SMS); Two Island River, Lake Co., May, 1925, 2614 (SMS); Oneota, Duluth, St. Louis Co., Sept., 1927, 3058 (SMS).

CEPHALOZIELLA MYRIANTHA (Lindb.) Schiffn. Oneota, Duluth, St. Louis Co., Aug., 1909, *Conklin* (SMS); Carlton, Carlton Co., Sept., 1909, 687 (SMS); Pigeon River, Cook Co., Aug., 1927, 3076 (SMS).

CEPHALOZIELLA RUBELLA (Nees) Dumort. Carlton, Carlton Co., Sept., 1909, *Conklin*, 650 (SMS); Fairmount Park, Duluth, St. Louis Co., July, 1911, 1567 (SMS); Condon Park, Aug., 1911, 1744 (SMS); Lutsen, Cook Co., Sept., 1911, 1305 (SMS); Cascade River, July, 1921, 1307 (SMS).

CEPHALOZIELLA SULLIVANTII (Aust.) Evans. Lutsen, Cook Co., Sept., 1911, *Conklin* 1302 (SMS).

HARPANTHACEAE

LOPHOCOLEA HETEROPHYLLA (Schrad.) Dumort. Winona, Winona Co., May and Aug., 1890, *Holzinger* (UM); Grand Marais, Cook Co., June, 1891, *Cheney* (UW); Winona, Winona Co., May, 1893, *Holzinger;* Grand Marais, Cook Co., Aug., 1901, *MacM. L. & B.* 22, 28 (YU); Grand Portage Island, Aug., 1902, *Holzinger* (UM & YU); Little Devils Track Trail, July, 1902 (UM & YU); Hat Point, Aug., 1902 (UM); Chester Creek, Duluth, St. Louis Co., July, 1909, *Conklin* 904 (SMS & YU); Knife River, Lake Co., Aug., 1909, 830, 630, 844 (SMS & YU); Oneota, Duluth, St. Louis Co., Aug., 1909, 937 (SMS); Carlton, Carlton Co., Sept., 1909, 1158, 683, 685 (SMS & YU); Collegeville, Stearns Co., April and May, 1910, *Rev. Jas. Hansen* 10 (SMS); Condon Park, Duluth, St. Louis Co., Aug., 1911, *Conklin* 1718 (SMS); Spirit Lake, Aug., 1911, 1603 (SMS); Lutsen, Cook Co., Sept., 1911, 1174 (SMS); Lester River, St. Louis Co., Oct., 1911, 1093 (SMS); Red Wing, Goodhue Co., Aug., 1919, *Holzinger* 11, 71 (YU); same location, Aug., 1919, 14, 15 (YU); Aug., 1919, 21 (YU); Aug., 1919 (YU); Sept., 1919, 27, 28 (YU); Sept., 1919, 30 (YU); Sept., 1919, 31 (YU); Lamoille, Winona Co., Oct., 1919, 33, 34, 37 (YU); Utica, Aug., 1920 (UM); Hungry Jack Lake, Cook Co., Aug., 1924, *Conklin* 2270, 2296 (SMS); Pigeon River, Sept., 1925, 2521 (SMS); Pine Island, Lake Vermilion, St. Louis Co., Sept., 1927, 3064 (SMS); S. W. Dedion, Minneapolis, Hennepin Co., Aug., 1925, *M. C. VanWert* H.33 (SMS).

LOPHOCOLEA MINOR Nees. Marine Falls, Washington Co., July, 1890, *Holzinger* (UM); Winona, Winona Co., Sept., 1890 (UM); same location, May and Oct., 1893 (UM); Homer, April, 1895 (UM); Minnesota Island, Leech Lake, Cass Co., July, 1896, *Conway MacMillan* (UM & YU); Winona, Winona Co., Sept., 1896, *Holzinger* (UM); Bear Creek, April, 1897 (UM); Winona Bluffs, May, Aug., and Oct., 1903 (UM); Winona, May, 1905 (UM); Knife River, Lake Co., Aug., 1909, *Conklin* 988, 862 (SMS & YU); Carlton, Carlton Co., Sept., 1909, 655, 693 (SMS & YU); French River, St. Louis Co., Oct.,

1909, 519, 623 (SMS); same location, Sept., 1910, 1221 (SMS); Lester River, Oct., 1910, 1094 (SMS); Winona, Winona Co., Sept., 1911, *Holzinger* (UM); Lutsen, Cook Co., Sept., 1911, *Conklin* 1192 (SMS); Condon Park, Duluth, St. Louis Co., Aug., 1911, 1599 (SMS); Lamoille, Winona Co., Nov., 1912, *Holzinger* 1A, 2B, 3 (UM); Red Wing, Goodhue Co., Aug., 1919, 9 (YU); (UM); Pine Island, Lake Vermilion, St. Louis Co., Sept., 1927, *Conklin* 3065 (SMS).

CHILOSCYPHUS FRAGILIS (Roth) Schiffn. Hungry Jack Lake, Cook Co., Aug., 1924, *Conklin* 2284 (SMS).

CHILOSCYPHUS PALLESCENS (Ehrh.) Dumort. Vasa, Goodhue Co., 1903, *N. L. T. Nelson* (UM); Oneota, Duluth, St. Louis Co., Sept., 1909, *Conklin* 501, 914 (SMS & YU); Lamoille, Winona Co., Oct., 1919, *Holzinger* (UM); Pine Island, Lake Vermilion, St. Louis Co., Sept., 1927, *Conklin* 3060 (SMS & YU).

CHILOSCYPHUS POLYANTHUS (L.) Corda. Bear Creek, Winona Co., May, 1880, *Holzinger* (UM); Winona, May, 1890 (UM); Woodland, Duluth, St. Louis Co., May, 1909, *Conklin* 446 (SMS); Knife River, Lake Co., Aug., 1909, 814 (SMS); Hungry Jack Lake, Cook Co., Sept., 1924, 2294 (SMS).

CHILOSCYPHUS RIVULARIS (Schrad.) Loeske. International Boundary, Cook Co., Sept., *MacMillan* 53.

MYLIA ANOMALA (Hook.) S. F. Gray. Beaver Dam, Hungry Jack Trail, Cook Co., Sept., 1924, *Conklin* 2315 (SMS); Pigeon River, July, 1926, 2677, 2699 (SMS); same location, Aug., 1927, 3039 (SMS).

HARPANTHUS SCUTATUS (Web. & Mohr) Spruce. Marine Mills, Washington Co., 1890, *Holzinger* (UM); Franconia, Chisago Co., July, 1890 (UM); Little Devils Track Trail, Cook Co., July, 1902 (UM); Grand Marais, July to Aug., 1902 (SMS, & UM & YU); (reported as *H. Flotowianus*); Oneota, Duluth, St. Louis Co., July, 1909, *Conklin* 777 (SMS & YU); Knife River, Lake Co., Aug., 1909, 822 (SMS); Fairmount Park, Duluth, St. Louis Co., July, 1911, 2025 (SMS); Spirit Lake, Duluth, Aug., 1911, 1640 (SMS); Red Wing, Goodhue Co., Aug., 1919, *Holzinger* (UM); Hungry Jack Lake, Cook Co., Aug., 1924, *Conklin* 2287 (SMS); Pigeon River, Sept., 1925, 2591 (SMS); Grand Marais, Aug., 1926, 2660 (SMS).

GEOCALYX GRAVEOLENS (Schrad.) Nees. Bear Creek, Winona Co., May, 1890, *Holzinger* (UM); Woodland, Duluth, St. Louis Co., May, 1907, *Conklin* 445, 1105 (SMS); Knife River, Lake Co., Aug., 1909, 860 (SMS); Collegeville, Stearns Co., March, 1910, *Rev. Jas. Hansen* 7 (SMS); Lutsen, Cook Co., Sept., 1911, *Conklin* 1194 (SMS); Briery, Pike Lake Road, St. Louis Co., July, 1912, 1662 (SMS); French River, Sept., 1916, 2138 (SMS); Hungry Jack Lake, Cook Co., Aug., 1924, 2317, 2316 (SMS); Moss Lake, Aug., 1924, 2272 (SMS); Pigeon River, Sept., 1925, 2530 (SMS); Two Island River, Lake Co., May, 1925, 2601 (SMS); Hat Point, Grand Portage, Cook Co., Aug., 1927, 3121 (SMS).

LOPHOZIACEAE

LOPHOZIA ALPESTRIS (Schleich.) Evans. Oneota, St. Louis Co., Aug., 1907, *Conklin* 790, 933, 909 (SMS & YU); Chester Creek, Duluth, July, 1909, 880 (SMS & YU); Oneota, July, 1910, 1035 (SMS); Nopeming, Nov., 1916, 1380 (SMS); Mt. Baldy, Oneota, Duluth, Sept., 1923, 1037, 1035 (SMS); Oneota, Duluth, Sept., 1923, 1862, 1862A (SMS & YU); Two Island River, Lake Co., May, 1925, 2623 (SMS); Grand Marais, Cook Co., July, 1926, 2689 (SMS); same location, Aug., 1926, 2670 (SMS); Hat Point, Grand Portage, Aug., 1927, 3128 (SMS).

LOPHOZIA EXCISA (Dicks.) Dumort. Stillwater, Washington Co., July, 1890, *Holzinger* (UM); Chester Creek, Duluth, St. Louis Co., July, 1909, *Conklin* 887, 885 (SMS & YU); Fairmount Park, Duluth, July, 1911, 2123 (SMS); Chester Creek, Duluth, St. Louis Co., Aug., 1912, 1233 (SMS); Oneota, Duluth, April, 1923, 1860, 1858 (YU); Hungry Jack Lake, Cook Co., April, 1924, 2342 (SMS); Oneota, Duluth, St. Louis Co., Sept., 1927, 3054 (SMS); Grand Marais, Cook Co., July, 1926, 2687 (SMS).

LOPHOZIA GRANDIRETIS (Lindb.) Schiffn. Grand Marais, Cook Co., Aug., 1926, *Conklin* 2652 (SMS); same location, Aug., 1927, 3062 (SMS).

LOPHOZIA INCISA (Schrad.) Dumort. Lamoille, Winona Co., Oct., 1893, *Holzinger* (UM); Gunflint Lake Trail, Cook Co., Aug., 1901, *MacM. L. & B.* 48pp (UM & YU); Grand Marais, July, Aug., 1902, *Holzinger* (UM); Grand Portage Island, Aug., 1902 (UM & YU); Hat Point, Aug., 1902 (UM & YU); Gunflint Trail, July, 1902 (UM); Knife River, Lake Co., Aug., 1909, *Conklin* 803 (SMS & YU); French River, St. Louis Co., Oct., 1909, 694, 695 (SMS & YU); Lutsen, Cook Co., Sept., 1911, 1130 (SMS); Briery, Pike Lake Road, St. Louis Co., July, 1912, 1663 (SMS); Nopeming, June, 1916, 1344 (SMS); Hungry Jack Lake, Cook Co., Aug., 1924, 2310 (SMS); Beaver Dam, Hungry Jack Trail, Sept., 1924, 2308 (SMS); Two Island River, Lake Co., May, 1925, 2604 (SMS); Pigeon River, Cook Co., Sept., 1925, 2595 (SMS); Grand Marais, July, 1926, 2686 (SMS); Arrowhead River, Sept., 1926, 2566, 2564 (SMS); Hat Point, Grand Portage, May, 1927, 3119 (SMS).

LOPHOZIA LONGIDENS (Lindb.) Macoun. Camp VIII Safety Island, Lake Co., June, 1897, *Holzinger* (UM); Grand Portage Island, Cook Co., Aug., 1902 (UM); Grand Marais, July to Aug., 1902 (UM); Lutsen, Sept., 1911, *Conklin* 1126, 2090 (SMS); Nopeming, St. Louis Co., Nov., 1916, 1382 (SMS); Hat Point, Grand Portage, Cook Co., Aug., 1927, 3122 (SMS).

LOPHOZIA LONGIFLORA (Nees) Schiffn. Beaver Dam, Hungry Jack Trail, Cook Co., Sept., 1924, *Conklin* 2356 (SMS); Grand Marais, Aug., 1926, 2665 (SMS).

LOPHOZIA MARCHICA (Nees) Steph. Pigeon River, Cook Co., July, 1926, *Conklin* 2650 (SMS).

LOPHOZIA PORPHYROLEUCA (Nees) Schiffn. Old Iron Trail, Cook Co., July, 1902, *Holzinger* (UM); Gunflint Trail, July, 1902 (UM); Lutsen, Sept., 1911, *Conklin* 241, 1330, 1409 (SMS); Briery, Pike Lake Road, St. Louis Co., July, 1912, 1660 (SMS); Hungry Jack Lake, Cook Co., Aug., 1924, 2312, 2313 (SMS); Beaver Dam, Hungry Jack Trail, Sept., 1924, 2295, 2417 (SMS).

LOPHOZIA VENTRICOSA (Dicks.) Dumort. Stillwater, Washington Co., July, 1890, *Holzinger* (UM); Lake Saganaya, Cook Co., June, 1897 (UM & YU); Safety Island, Lake Co., Camp VIII, 1897, "A" (UM); Stair Portage, Cook Co., Aug., 1901, *MacM. L. & B.* (YU); Grand Marais, 1901, 231pp. (UM); between N. & S. Lake Portage, 1901, 143pp (UM); Grand Marais, July to Aug., *Holzinger* (UM & YU); Gunflint Lake Trail, July to Aug. (UM); Hat Point, Aug., 1902 (UM & YU); Chester Creek, Duluth, St. Louis Co., July, 1909, *Conklin* 888, 889 (SMS & YU); Knife River, Lake Co., Aug., 1909, 491, 691, 853 (SMS & YU); Thompson, Carlton Co., Sept., 1909, 658, 1162, 1219 (SMS & YU); Oneota, Duluth, St. Louis Co., Sept., 1909, 939 (SMS & YU); Carlton Swamp, Carlton Co., Sept., 1911, 1680 (SMS); Nopeming, St. Louis Co., Nov., 1916, 1385, 1397 (SMS); Cascade River, Cook Co., July, 1921, 1359 (SMS); Nopeming, St. Louis Co., May, 1923, 1845 (SMS); Hungry Jack Lake, Cook Co., July, 1924, 1242, 1246 (SMS); Cascade River, Sept., 1924, 2344 (SMS); Hat Point, Grand Portage, Aug., 1927, 3125 (SMS).

LEIOCOLEA BADENSIS (Gottsche) Joerg. Stillwater, Washington Co., July, 1890, *Holzinger* (UM); Mission Creek, Fond du Lac, St. Louis Co., April, 1923, *Conklin* 1750, 1784 (SMS & YU); Grand Marais, Cook Co., July, 1926, 2683 (SMS); same location, Aug., 1926, 2668 (SMS).

LEIOCOLEA GILMANI (Aust.) Evans. Grand Marais, Cook Co., July to Aug., 1902, *Holzinger* (UM); Lutsen, Sept., 1911, *Conklin* 1528, 1125 (SMS & YU); Cascade River, July, 1921, 1476 (SMS); same location, Sept., 1924, 2345 (SMS); Two Island River, Lake Co., May, 1925, 2522, 2620 (SMS); Gooseberry River, July, 1925, 2629 (SMS); Grand Marais, July, Aug., 1926, 2690, 3008 (SMS).

LEIOCOLEA HETEROCOLPA (Thed.) Buch. Grand Marais, Cook Co., June, 1891, *Cheney* (UW); same location, July and Aug., 1902, *Holzinger* (UM & YU); Chester Creek, Duluth, St. Louis Co., July, 1909, *Conklin* 878 (SMS);

Knife River, Lake Co., Aug., 1909, 800 (SMS); French River, St. Louis Co., Oct., 1909, 702 (SMS); same location, Sept., 1910, 1646 (YU); Fairmount Park, Duluth, St. Louis Co., July, 1911, 1566 (SMS & YU); Condon Park, Aug., 1911, 1582 (SMS); Spirit Lake, Sept., 1911, 1604 (SMS); Lutsen, Cook Co., Sept., 1911, 1118 (SMS); Cascade River, Sept., 1924, 2352B (SMS); Thompson, Carlton Co., Oct., 1924, 2441A (SMS); Two Island River, Lake Co., May, 1925, 2583 (SMS); Grand Marais, July, 1926, 2684 (SMS); same location, Aug., 1926, 2667 (SMS).

LEIOCOLEA RUTHEANA (Limpr.) Evans. Grand Marais, Cook Co., July to Aug., 1902, *Holzinger* (SMS & YU); Gooseberry River, Lake Co., July, 1925, *Conklin* 3021 (SMS); Grand Marais, Cook Co., Aug., 1926 (SMS).

ISOPACHES BICRENATUS (Schmid.) Buch. Thompson, Carlton Co., Sept., 1909, *Conklin* 652, 910 (SMS & YU); Pigeon River, Cook Co., Sept., 1925, 2522 (SMS); Oneota Ravine, Duluth, St. Louis Co., Sept., 1927, 2522 (SMS).

ISOPACHES HELLERIANUS (Nees) Buch. Grand Marais, Cook Co., June, 1891, *Cheney* 27 (UM & YU); U. S. Peninsula, Basswood Lake, Lake Co., June, 1897, *Holzinger* (UM); Portage N. & S. Lakes, Cook Co., Aug., 1901, *MacM. L. & B.* 143pp (YU); Little Devils Track Trail, Cook Co., July, 1902, *Holzinger* (UM); Old Iron Trail, July, 1902 (UM); Gunflint Trail, July, 1902, (UM); Hat Point, Aug., 1902 (UM); Carlton, Carlton Co., Sept., 1909, *Conklin* 660pp (SMS & YU); French River, St. Louis Co., Oct., 1909, 601, 1053 (SMS & YU); Lutsen, Cook Co., Sept., 1911, 1109 (SMS); Briery, Pike Lake Road, St. Louis Co., July, 1913, 1231A (SMS); Hungry Jack Lake, Cook Co., Aug., 1924, 2285, 2251 (SMS); Duncan Lake, Sept., 1924, 2266 (SMS); Pigeon River, Aug., 1927, 3048 (SMS).

SPHENOLOBUS MINUTUS (Crantz) Steph. Grand Marais, Cook Co., June, 1891, *Cheney & F. F. Wood* 125 (NY & UW); Lutsen, Sept., 1911, *Conklin* 1733 (SMS); Nopeming, St. Louis Co., June, 1916, 1266 (SMS); Cascade River, Cook Co., July, 1921, 1350, 1352 (SMS); Nopeming, St. Louis Co., May, 1922, 1844 (SMS); Hungry Jack Lake, Cook Co., July, 1924, 2253 (SMS); Cascade River, Sept., 1924, 2348 (SMS).

ANASTROPHYLLUM MICHAUXII (Web.) Buch. Stair Portage, Cook Co., Aug., 1901, *MacM. L. & B.* 182 (UM & YU); Little Devils Track Trail, July, 1902, *Holzinger* (UM); Gunflint Trail, July, 1902 (UM); Lutsen, Sept., 1911, *Conklin* 1123, 1693 (SMS); Briery, Pike Lake Road, St. Louis Co., July, 1913, 1444, 2074 (SMS); Hungry Jack Lake, Cook Co., Aug., 1924, 2250, 2338 (SMS); Two Island River, Lake Co., May, 1925, 2621 (SMS).

GYMNOCOLEA INFLATA (Huds.) Dumort. St. Louis River, St. Louis Co., July, 1886, *A. B. & H.* 126A (UM).

TRITOMARIA EXSECTA (Schmid.) Schiffn. Grand Marais, Cook Co., July to Aug., 1902, *Holzinger* (SMS & UM & YU); Oneota, Duluth, St. Louis Co., June, 1909, *Conklin* 774, 782 (SMS); French River, Oct., 1909, 614, 615 (SMS & YU); Fairmount Park, Duluth, July, 1911, 1609 (SMS); Lutsen, Cook Co., Sept., 1911, 1189, 1574 (SMS); Lamoille, Winona Co., Oct., 1919, *Holzinger* (YU); Hungry Jack Lake, Cook Co., July, 1924, *Conklin* 2271 (SMS); Pigeon River, Sept., 1925, 2593 (SMS); Two Island River, Lake Co., May, 1925, 2618 (SMS); Grand Marais, Cook Co., July, 1926, 3001 (SMS); same location, Aug., 1927, 3024 (SMS).

TRITOMARIA EXSECTIFORMIS (Breidl.) Schiffn. Grand Marais, Cook Co., June, 1891, *Cheney* 45 (UW & UM & NY); (listed as *Sphenolobus exsectus*); same location, July to Aug., 1902, *Holzinger* (UM & YU); Knife River, Lake Co., Aug., 1909, *Conklin* 619 (SMS & YU); Carlton, Carlton Co., Sept., 1909, 601A (SMS); Oneota, Duluth, St. Louis Co., Sept., 1909, 784 (SMS); French River, Oct., 1909, 636, 696 (SMS); Lutsen, Cook Co., Sept., 1911, 1190 (SMS); Hungry Jack, Moss & Duncan Lakes, Aug., 1924, 2305, 2306 (SMS); Nopeming, St. Louis Co., June, 1916, 1344 (SMS); Two Island River, Lake Co., May, 1925, 2605 (SMS); Arrowhead River (Brule), Cook Co., Sept., 1925, 2568 (SMS); Grand Marais, July, 1926, 3013 (SMS); Pigeon River, Aug., 1927, 3047 (SMS); Hat Point, Grand Portage, Aug., 1927, 3114 (SMS).

TRITOMARIA QUINQUEDENTATA (Huds.) Buch. Minnesota, July, 1891, *F. F. Wood* (U. S. Nat. Herb. listed as *L. incisa*), (NY); Grand Marais, Cook Co., June, 1891, 55 (NY & UW); Grand Marais, July to Aug., *Holzinger* (UM); Minnesota, 1891, *Cheney* "B" (NY & UW); Grand Portage Island, June, 1897, *Holzinger* 8 (UM); Pipestone Rapids, Basswood Lake, Lake Co., June, 1897, (UM); Portage Island, Cook Co., Camp II, June, 1897 (UM & YU); Portage between N. & S. Lakes, Aug., 1901, *MacM. L. & B.* 143pp (UM & YU); Stair Portage, Aug., 1901, 181pp (UM & YU); Grand Portage Island, Aug., 1902, *Holzinger* (UM); Mt. Josephine, Aug., 1902 (UM & YU); Hat Point, Aug., 1902 (UM & YU); Oneota, Duluth, St. Louis Co., June, 1909, *Conklin* 82 (SMS & YU); Chester Creek, July, 1909, 930 (SMS); Knife River, Lake Co., Aug., 1909, 876, 376 (SMS & YU); Carlton, Carlton Co., Sept., 1909, 656 (SMS); Fairmount Park, Duluth, St. Louis Co., July, 1911, 1614 (SMS); Condon Park, Aug., 1911, 1598 (SMS); Spirit Lake, Aug., 1911, 1636 (SMS); Lutsen, Cook Co., Sept., 1911, 1191 (SMS); Nopeming, St. Louis Co., July, 1916, 1269 (SMS); same location, Nov., 1916, 1379 (SMS); Cascade River, Cook Co., July, 1921, 1477 (SMS); Oneota, St. Louis Co., Sept., 1923, 1865 (SMS); Duncan Lake, Cook Co., July, 1924, 2258 (SMS); Hungry Jack Lake, Aug., 1924, 2364 (SMS); Cascade River, Sept., 1924, 2349 (SMS); Two Island River, Lake Co., Nov., 1924, 2503, 2608 (SMS); Little Carabou River, Cook Co., Sept., 1925, 2575 (SMS); Grand Marais, Aug., 1926, 2656 (SMS); Grand Marais, July, 1927, 2685 (SMS); Hat Point, Grand Portage, Aug., 1927, 3117 (SMS); Oneota Ravine, Duluth, St. Louis Co., Sept., 1927, 3056 (SMS).

TRITOMARIA SCITULA (Tayl.) Joerg. Grand Marais, Cook Co., July, 1926, *Conklin* 2653 (SMS).

ORTHOCAULIS ATTENUATUS (Mart.) Evans. French River, St. Louis Co., Aug., 1909, *Conklin* 601 (SMS); Carlton, Carlton Co., Sept., 1909, 601A (SMS); Lutsen, Cook Co., Sept., 1911, 1121 (SMS); Nopeming, St. Louis Co., May, 1912, 1743 (SMS); same location, Nov., 1916, 1396 (SMS); Oneota, Sept., 1923, 1864 (SMS).

BARBILOPHOZIA BARBATA (Schmid.) Loeske. International Boundary, Cook Co., Sept., 1895, *MacMillan* 56; Taylors Falls, Chisago Co., Aug., 1896, *Holzinger* (UM); Fall Lake, Lake Co., June, 1897, 7 (UM & YU); Gunflint Lake, Grand Portage, Cook Co., June, 1897 (UM); Grand Portage Island, June, 1897 (UM); S. Fowl Lake to Pigeon River, June, 1897 (UM); Grand Marais, Aug., 1901, *MacM. L. & B.* 183, 238pp (UM & YU); Stair Portage, Aug., 1901, 181pp (UM); Mt. Josephine, Aug., 1902, *Holzinger* (UM & YU); Grand Marais, July, Aug., 1902 (UM & YU); Hat Point, July, Aug., 1902 (UM); Chester Creek, Duluth, St. Louis Co., July, 1909, *Conklin* 894, 928 (SMS & YU); Oneota, Duluth, Aug., 1909, 908, 919 (SMS & YU); Carlton, Carlton Co., Sept., 1909, 668 (SMS & YU); French River, St. Louis Co., Oct., 1909, 645 (SMS); Lutsen, Cook Co., Sept., 1911, 1175 (SMS); Fairmount Park, Duluth, St. Louis Co., July, 1911, 2058 (SMS); Condon Park, Aug., 1911, 1597 (SMS); Spirit Lake, Aug., 1911, 1644 (SMS); Nopeming, Nov., 1916, 1398 (SMS); Hungry Jack Lake, Cook Co., July, 1924, 2329, 2274 (SMS); Moss Lake, Sept., 1924, 2331 (SMS); Carlton, Carlton Co., Sept., 1924, 2042 (SMS); Pigeon River, Cook Co., Sept., 1925, 2524, 2581 (SMS); Gooseberry River, Lake Co., July, 1925, 2631 (SMS); Hat Point, Grand Portage, Cook Co., Aug., 1927, 3117, 3127 (SMS); Pine Island, Lake Vermilion, St. Louis Co., Sept., 1927, 3066 (SMS).

JUNGERMANNIA LANCEOLATA L. Oneota, Duluth, St. Louis Co., Jan., 1909, *Conklin* 772 (SMS); (YU); French River, Oct., 1909, 514 (SMS); Lutsen, Cook Co., Sept., 1911, 2003 (SMS); Hungry Jack Lake, Aug., 1924, 2293 (SMS); Two Island River, Lake Co., May, 1925, 2597 (SMS).

JUNGERMANNIA PUMILA With. Rosebush Falls, Cook Co., July, 1902, *Holzinger* (UM); Chester Creek, Duluth, St. Louis Co., July, 1909, *Conklin* 886 (SMS & YU); French River, Oct., 1909, 1114 (SMS); Fairmount Park, Duluth, July, 1911, 1731 (SMS); Lutsen, Cook Co., Sept., 1911, 1187 (SMS); Cascade River, July, 1921, 1480 (SMS); Grand Marais, Aug., 1926, 2666 (SMS).

JUNGERMANNIA SCHIFFNERI (Loitlesb.) Evans. French River, St. Louis Co., Sept., 1910, *Conklin* 1777 (SMS); Fairmount Park, Duluth, July, 1911, 2052 (SMS); Grand Marais, Cook Co., Aug., 1926, 3010 (SMS).

JUNGERMANNIA SPHAEROCARPA Hook. Rosebush Falls, Cook Co., nr. Grand Marais, July, 1902, *Holzinger* (UM); French River, St. Louis Co., Sept., 1910, *Conklin* 1595 (SMS); Lutsen, Cook Co., Sept., 1911, 1155, 1187 (SMS & YU); Cascade River, July, 1921, 1360 (SMS & YU); Little Carabou River, Sept., 1925, 2574 (SMS).

JAMESONIELLA AUTUMNALIS (DC.) Steph. St. Louis River, St. Louis Co., July, 1886, *A. B. & H.* 12A (NY); same location, 126, 126A (UM); Winona, Winona Co., June, 1890, *Holzinger* (NY & UM); Winona Bluffs, May, 1890, (NY & UM); Bear Creek, Winona, May, 1890 (NY & UM); Homer, June, 1890, 8 (NY & UM); Franconia, Chisago Co., July, 1890 (UM); Grand Marais, Cook Co., June, 1891, *F. F. Wood* 45 (NY); same location, June, 1891, *Cheney* (UW); International Boundary, Cook Co., Sept., 1895, *MacMillan* 52; Fall Lake, Lake Co., June, 1897, *Holzinger* (UM & YU); North Lake to Gunflint Lake, Cook Co., June, 1897 (UM); Grand Marais, 1901, *MacM. L. & B.* 24 (UM & YU); Portage, N. & S. Lakes, 1901, 143pp (UM & YU); Stair Portage, Aug., 1901, 164 (UM & YU); Gunflint Trail, July, 1902, *Holzinger* (UM); Grand Portage Island, Aug., 1902 (UM & YU); Old Iron Trail, July, 1902 (UM); Little Devil's Track Trail, July, 1902 (UM & YU); Arrow Lake, *MacM. L. & B.*, Aug., 1901, Albert, Carlton Co., Aug., 1906, *Conklin* 242 (SMS); Woodland, St. Louis Co., May, 1909, 447 (SMS); Knife River, Lake Co., Aug., 1909, 848pp (SMS); Carlton, Carlton Co., Sept., 1909, 679 (SMS); French River, St. Louis Co., Sept., 1910, 1620 (SMS); Fairmount Park, Duluth, July, 1911, 1613 (SMS); Thompson, Sept., 1911, 1222 (SMS); Briery, Pike Lake Road, July, 1912, 2073 (SMS); Lutsen, Cook Co., Sept., 1911, 1179, 1202 (SMS); Red Wing, Goodhue Co., Aug., Sept., 1919, *Holzinger* 21pp (YU); Hungry Jack Lake, Cook Co., July, 1924, *Conklin* 2060, 2261, 2292 (SMS); Hat Point, Grand Portage, Aug., 1927, 3118 (SMS); Pine Island, Lake Vermilion, St. Louis Co., Sept., 1927, 3061 (SMS).

PLECTOCOLEA CRENULATA (Smith) Evans. Lamoille, Winona Co., Oct., 1893, *Holzinger* (UM).

PLECTOCOLEA HYALINA (Lyell) Mitt. St. Paul, Ramsey Co., *I. A. Lapham*, no date (U); (det. AWE), associated with *Reboulia hemisphaerica;* Lairds Springs, Winona Co., Aug., 1903, *Holzinger* (UM); Big Falls, Koochiching Co., July, 1905, *L. N. T. Nelson* 925 (YU); Two Island River, Lake Co., May, 1925, *Conklin* 2598 (SMS); Gooseberry River, July, 1925, 2632 (SMS); Grand Marais, Cook Co., Aug., 1926, 2663 (SMS).

MARSUPELLACEAE

MARSUPELLA EMARGINATA (Ehrh.) Dumort. Grand Marais, Cook Co., July, Aug., 1902, *Holzinger* (NY & UM & YU); Birchrock Hill, Nopeming, St. Louis Co., Nov., 1916, *Conklin* 1270 (SMS & YU); same location, Aug., 1922, 2124 (SMS).

PLAGIOCHILACEAE

PLAGIOCHILA ASPLENIOIDES (L.) Dumort. Grand Marais, Cook Co., June, 1891, *Cheney* 30 (UW & NY); same location, June, 1891, *F. F. Wood* 30 (NY); Taylors Falls, Chisago Co., Aug., 1896, *Holzinger* (UM); North Lake, Cook Co., 1897 (UM & YU); U. S. Peninsula, Lake Co., July, 1897 (UM); Grand Portage Island, Cook Co., June, 1897, *H. & Arthur Elftman* (UM); Gunflint Lake, June, 1897, *Holzinger* (UM); Bear Creek, Winona Co., April, 1897 (UM); Basswood Lake, Lake Co., June, 1897 (UM); Winona Bluffs, Winona Co., Oct., 1899 (UM); Rosebush Falls, Cook Co., July, 1902 (UM & YU); Grand Marais, July to Aug., 1902 (UM & YU); Grand Portage Island, Aug., 1902 (UM); Knife River, Lake Co., Aug., 1909, *Conklin* 863, 866 (SMS & YU); Carlton, Carlton Co., Sept., 1909, 664 (SMS); Oneota, Duluth, St. Louis Co., Sept., 1909, 973 (SMS); Chester Creek, July, 1909, 469 (SMS); French

River, Oct., 1909, 807, 657 (UW & YU); Collegeville, Stearns Co., May, 1910, *Rev. Jas. Hansen* 13 (SMS); Lester River, St. Louis Co., Oct., 1910, *Conklin* 1087 (SMS); Condon Park, Duluth, Aug., 1911, 1748, 1583 (SMS); Spirit Lake, Aug., 1911, 1600 (SMS); Nopeming, Nov., 1916, 1384 (SMS); Lutsen, Cook Co., Sept., 1911, 1188 (SMS); Blue Earth, Faribault Co., *W. H. Over*, Oct., 1920 (YU); Fond du Lac, St. Louis Co., May, 1923, *Conklin* 1784 (SMS); Hungry Jack Lake, Cook Co., July, 1924, 2262 (SMS); Moss Lake, Aug., 1924, 2302 (SMS); Duncan Lake, Aug., 1924, 2302A, 2354 (SMS); Cascade River, Sept., 1924, 2359 (SMS); Two Island River, Lake Co., May, 1925, 2475, 2510, 2602 (SMS); Pigeon River, Cook Co., Sept., 1925, 2520 (SMS); Arrowhead River, Sept., 1925, 2563 (SMS); Gooseberry River, Lake Co., July, 1925, 2627 (SMS); Little Carabou River, Cook Co., Sept., 1925, 2572 (SMS); Grand Marais, Aug., 1926, 2659 (SMS); Pine Island, Lake Vermilion, St. Louis Co., Sept., 1927, 3067 (SMS).

SCAPANIACEAE

DIPLOPHYLLUM APICULATUM (Evans) Steph. Taylors Falls, Chisago Co., Aug., 1896, *Holzinger* (UM); Nopeming, St. Louis Co., Nov., 1916, *Conklin* 1394 (SMS); same location, May, 1923, 1843 (SMS); Aug., 1923, 1843A (SMS).

SCAPANIA APICULATA Spruce. Spirit Lake, Duluth, St. Louis Co., Oct., 1907, *Conklin* 152 (SMS); French River, Lake Co., Sept., 1910, 1622 (SMS); Spirit Lake, Duluth, St. Louis Co., Aug., 1911, 1602 (SMS); Lutsen, Cook Co., Sept., 1911, 1120 (SMS & YU); Two Island River, Lake Co., May, 1925, 2476 (SMS).

SCAPANIA CURTA (Mart.) Dumort.[2] Grand Marais, Cook Co., June, 1891, *Cheney* (UW); Grand Marais, July to Aug., 1902, *Holzinger* (UM); Carlton, Carlton Co., Sept., 1909, *Conklin* 662 (SMS); French River, St. Louis Co., Oct., 1909, 520 (SMS); Thompson, Carlton Co., Sept., 1910, 1574 (SMS); Lester River, Duluth, St. Louis Co., Oct., 1910, 1011 (SMS); Fairmount Park, July, 1911, 1565 (SMS); Condon Park, Aug., 1911, 1664, 1782 (SMS); Spirit Lake, Aug., 1911, 1600 (SMS); Lutsen, Cook Co., Sept., 1911, 1193, 1792 (SMS); Nopeming, St. Louis Co., May, 1921, 1470 (SMS); Oneota, Duluth, Sept., 1923, 1864 (SMS); Hungry Jack Lake, Cook Co., July, 1924, 2245 (SMS); Pigeon River, Sept., 1925, 2582 (SMS); Arrowhead River, Sept., 1925, 2535 (SMS); Little Caribou River, Sept., 1925, 2582 (SMS); Grand Marais, July, 1926, 3003, 3006 (SMS); Oneota, Duluth, St. Louis Co., Sept., 1927, 3059A (SMS).

SCAPANIA GYMNOSTOMOPHILA Kaal. Lester Park, Duluth, St. Louis Co., Oct., 1910, *Conklin* 1011pp, 1627 (SMS); Condon Park, Aug., 1911, 1749 (SMS); Lutsen, Cook Co., Sept., 1911, 1727 (SMS); Two Island River, Lake Co., May, 1925, 2619 (SMS); Pigeon River, Cook Co., Sept., 1925, 2527, 2534 (SMS); Grand Marais, Aug., 1927, 3025 (SMS).

SCAPANIA IRRIGUA (Nees) Dumort. Fairmount Park, Duluth, St. Louis Co., July, 1911, *Conklin* 1746 (SMS); Hoveland, Cook Co., Sept., 1925, 2486, 2634A, 2634 (SMS); Grand Marais, Aug., 1926, 2664 (SMS); Hoveland, Aug., 1927, 3027 (SMS).

SCAPANIA MUCRONATA Buch. Oneota, Duluth, St. Louis Co., June, 1909, *Conklin* 750, 953 (SMS & YU 43); fide H. Buch; Chester Creek, Duluth, July, 1909, 899 (SMS) & YU 44) fide H. Buch; same location, July, 1909 (C. C. Haynes N. A. Hep. 75) (SMS & YU 41) fide H. Buch; Knife River, Lake Co., Aug., 1909, 836 (SMS & YU 42) fide H. Buch; Carlton, Carlton

[2] The composite species *Scapania curta* has recently been studied by Dr. H. Buch and split into several species. Some of the specimens collected in Minnesota have been submitted to Dr. Buch by Dr. Evans and have been named by him *S. mucronata*. These specimens have been listed under that species and the remainder of the specimens listed under *S. curta*.

Co., Sept., 1909, 651 (SMS & YU 47) fide H. Buch, sterile; French River, St. Louis Co., Oct., 1909, 711 (SMS & YU 48) doubtful; Lutsen, Cook Co., Sept., 1911, 1468 (SMS & YU 46) fide H. Buch; Carlton, Carlton Co., Oct., 1911, 1439 (SMS & YU) fide H. Buch; Thompson, St. Louis River Dells, Oct., 1911, 1159 (SMS & YU 46) fide H. Buch.

SCAPANIA NEMOROSA (L.) Dumort, Grand Marais, Cook Co., June, 1891, *Cheney* (UW); Taylors Falls, Chisago Co., Aug., 1896, *Holzinger* (UM); Grand Marais, Cook Co., July to Aug., 1902 (UM & YU 4A, 3A, 6A) fide C. Muller; Gunflint Trail, July, 1902 (UM); Oneota, Duluth, St. Louis Co., July, 1909, *Conklin* 911, 924, 969 (SMS & YU); Nopeming, July, 1916, 1358, 1376, 1274 (SMS & YU); same location, May, 1923, 1841, 2020 (SMS); Oneota, Duluth, Sept., 1923, 1863 (SMS); Grand Marais, Cook Co., July, 1926, 2693 (SMS); same location, Aug., 1926, 2771, 2695 (SMS); Oneota, Duluth, St. Louis Co., Sept., 1927, 3059 (SMS).

SCAPANIA PALUDICOLA Loeske & K. Müll. Beaver Dam, Hungry Jack Trail, Cook Co., Sept., 1924, *Conklin* 2357 (SMS).

SCAPANIA SUBALPINA (Nees) Dumort. Rosebush Falls, Cook Co., July, 1902, *Holzinger* (UM); Grand Portage Island, Aug., 1902 (UM); Grand Marais, Aug. to Sept., 1902 (UM & YU 2A, 1A) fide C. Muller, "Transcend ad Sc. dentata"; Cascade River, Sept., 1924, *Conklin* (SMS); Two Island River, Lake Co., May, 1925, 2617 (SMS); Grand Marais, Cook Co., Aug., 1926, 2655 (SMS).

SCAPANIA UMBROSA (Schrad.) Dumort. Knife River, Lake Co., July, 1909, *Conklin* 347, 825, 827 (SMS).

SCAPANIA UNDULATA (L.) Dumort. Grand Marais, Cook Co., July to Aug., 1902, *Holzinger* (YU); fide C. Muller 5A; Grand Marais, July, 1926, *Conklin* 3009 (SMS). Clear Lake, Gunflint Trail, Cook Co., Aug., 1901, *MacM. L. & B.* (UM & YU); Gunflint Trail, July, 1901, *Holzinger* (UM & YU); French River, St. Louis Co., Oct., 1909, *Conklin* 503 (SMS & YU); doubtful; Lutsen, Cook Co., Sept., 1911, 1156 (SMS & YU); Two Island River, Lake Co., May, 1924, 2471 (SMS); same location, Aug., 1926, 2676 (SMS).

SCAPANIELLA GLAUCOCEPHALA (Tayl.) Evans. Fall Lake, Lake Co., June, 1897, *Holzinger* (UM & YU); Old Iron Trail, nr. Grand Marais, Cook Co., July, 1902 (UM); Lutsen, Sept., 1911, *Conklin* 1206A, 1205A, 1195 (SMS); Pine Island, Lake Vermilion, St. Louis Co., Sept., 1927, 3073 (SMS).

PORELLACEAE

PORELLA PINNATA L. St. Croix Falls, Chisago Co., July, 1890, *Holzinger;* Carlton, Carlton Co., Sept., 1910, *Conklin* 938, 958 (SMS).

PORELLA PLATYPHYLLA (L.) Lindb. Lake Vermilion, St. Louis Co., July, 1886, *A. B. & H.* 114, 114A (NY); Winona, Winona Co., April, 1890, *Holzinger* (UM); Bear Creek, May, 1890 (UM); Winona, May, 1890 (UM & NY); Lamoille, June, 1890 (UM); Fond du Lac, St. Louis Co., June, 1891, *F. F. Wood* 26 (UM & UW); Aitkin, Aitkin Co., June, 1892, *E. P. Sheldon,* S-2533 (UM); Taylors Falls, Chisago Co., Aug., 1894, *Holzinger* (UM); Leech Lake, Cass Co., July, 1895, *U. S. Cox* (NY); Minnesota Island, Leech Lake, Cass Co., July, 1896, *Conway MacMillan* (UM); Big Bay, Cook Co., 1896, *Cheney* 5705 (UW & NY); U. S. Peninsula, Lake Co., June, 1897, *Holzinger* (UM); Fall Lake, Lake Co., June, 1897 (UM & YU); Lairds Spring, Winona Co., Aug., 1897 (UM); Stair Portage, Cook Co., June, 1897, *MacM. L. & B.* 42 (YU); (listed as *P. rivularis* (9)); Granite Falls, Yellow Medicine Co., June, 1901, *Holzinger* (UM); Winona Bluffs, Winona Co., Sept., Oct., 1901 (UM); Wykoff, Fillmore Co., April, 1901 (UM); Osceola, Chisago Co., May, 1901, *Daisy S. Howe* 26 (UM); Winona, Winona Co., April, 1901, *Holzinger* (UM); Montivedeo, Chippewa Co., July, 1901 (UM); Grand Marais, Cook Co., July to Aug., 1901 (UM); Cedar Lake, Hennepin Co., July, 1902 (SMS); Winona, Winona Co., Oct., 1902 (SMS) (Dr. Grout's

exsiccatae listed under *P. pinnata*); Winona, Oct., 1903 (SMS); same location, May, 1903 (UM); Oct., 1904 (UM); Lester River, St. Louis Co., Oct., 1906, *Conklin* 324 (SMS); Knife River, Lake Co., Aug., 1909, 811, 2163 (SMS); Collegeville, Stearns Co., May, 1910, *Rev. Jas. Hansen* 16 (SMS); Vasa, Goodhue Co., Aug., 1903, *N. L. T. Nelson* 5, 6 (YU); same location, July, 1905, 2985½ (YU); Lutsen, Cook Co., Sept., 1911, *Conklin* 1196 (SMS); Spirit Lake, Duluth, St. Louis Co., Aug., 1912, 1642 (SMS); Spring Grove, Houston Co., June, 1919, *Holzinger* (UM); Wacouta, Goodhue Co., Aug., 1919, 12 (UM); Red Wing, Aug., 1919, 8 (UM); same location, Sept., 1919 (UM); Fond du Lac, St. Louis Co., May, 1923, *Conklin* 1751 (SMS); Hungry Jack Lake, Cook Co., Aug., 1924, 2303 (SMS); Grand Marais, July, 1926, 2696 (SMS); Taylors Falls, Chisago Co., June, 1927, *M. C. VanWert* (SMS); Hat Point, Cook Co., Aug., 1927, *Conklin* 3022 (SMS); Lake Minnetonka, Hennepin Co., July, 1928, *M. C. Vanwert* H.32 (SMS).

PORELLA PLATYPHYLLOIDEA (Schwein.) Lindb. Old Iron Trail, Cook Co., June, 1902, *Holzinger* (9) (UM & YU); Albert, Carlton Co., Aug., 1905, *Conklin* 922 (SMS & YU); Lester River, Duluth, St. Louis Co., Oct., 1906, 465 (SMS); Knife River, Lake Co., Aug., 1909, 841 (SMS & YU); Lake City, Wabasha Co., Sept., 1909, *Holzinger* (YU); Red Wing to Wacouta, Goodhue Co., Sept., 1909, 25 (YU); Thompson, Carlton Co., Oct., 1910, *Conklin* 1583 (SMS); Lutsen, Cook Co., Sept., 1911, 1489 (SMS); Spring Grove, Houston Co., June, 1919, *Holzinger* 3, 4 (YU); Red Wing, Goodhue Co., July, Aug., 1919, 5, 6, 7, 18, 19 (YU); Wacouta, Aug., 1919, 12 (YU); Zumbro Falls, Wabasha Co., Oct., 1919, 32 (YU); Pigeon River, Cook Co., Sept., 1925, *Conklin* 2589 (SMS).

RADULACEAE

RADULA COMPLANATA (L.) Dumort. Fond du Lac, St. Louis Co., June, 1891, *Cheney* 120 (UW & NY); International Boundary, Cook Co., Sept., 1895, *MacMillan* 57; Bear Creek, Winona Co., July, 1896, *Holzinger* (NY); Ely, St. Louis Co., June, 1897 (UM); Grand Portage, Basswood Lake, Lake Co., June, 1897 (UM & YU); same location, Camp IV, June, 1897, 15 (UM); U. S. Peninsula, Lake Co., June, 1897 (UM & YU); Fall Lake, June, 1897 (UM & YU); Bear Creek, Winona Co., Sept., 1898 (UM & NY); Gunflint Trail, Cook Co., 1901, *MacM. L. & B.* 56 (UM); Old Iron Trail, July, 1902, *Holzinger* (UM & YU); Gunflint Trail, July, 1902 (UM); Grand Portage Island, Aug., 1902 (UM & YU); Grand Marais, July to Aug., 1902 (UM); Mt. Josephine, Aug., 1902 (UM); Hat Point, Aug., 1902 (UM); Lester River, St. Louis Co., Oct., 1906, *Conklin* (SMS); Knife River, Lake Co., Aug., 1909, 751, 831 (SMS & YU) det. Castle; Carlton, Carlton Co., Sept., 1909, 666, 674 (SMS); French River, St. Louis Co., Oct., 1909, 915 (SMS & YU) det. Castle; Lutsen, Cook Co., Sept., 1911, 1197 (SMS); Nopeming, St. Louis Co., Nov., 1916, 1387 (SMS); Condon Park, Duluth, July, 1922, 1596 (SMS); Pigeon River, Cook Co., Sept., 1925, 2533 (SMS); same location, Aug., 1927, 3037 (SMS).

RADULA OBCONICA Sulliv. Grand Marais, Cook Co., July to Aug., 1902, *Holzinger* (UM); Old Iron Trail, July, 1902 (UM); French River, Lake Co., Sept., 1910, *Conklin* 2140 (SMS); Lutsen, Cook Co., Sept., 1911, 1137 (SMS & YU); det. Castle; Cascade River, July, 1921, 1478 (SMS); Fond du Lac, St. Louis Co., April, 1923, 1751 (SMS); Hungry Jack Lake, Cook Co., Aug., 1924, 2339 (SMS); Pigeon River, Sept., 1924, 2590 (SMS); Two Island River, Lake Co., May, 1925, 2501 (SMS).

FRULLANIACEAE

FRULLANIA ASAGRAYANA Mont. Knife River, Lake Co., Aug., 1909, *Conklin* 498, 495, 1198 (SMS & YU); Carlton, Carlton Co., Sept., 1910, 957 (SMS); Lutsen, Cook Co., Sept., 1911, 1142 (SMS); Thompson, Carlton Co., Oct., 1911, 1161 (SMS).

FRULLANIA BOLANDERI Aust. Grand Marais, Cook Co., July to Aug., 1902, *Holzinger* (UM & SMS); Condon Park, Duluth, St. Louis Co., Aug., 1911, *Conklin* 2078 (SMS); Lutsen, Cook Co., Sept., 1911, 1238 (SMS); Pine Lake, Aitkin Co., Aug., 1913, 1245 (SMS); St. Louis River Dells, Carlton Co., Oct., 1924, 2365 (SMS); Hat Point, Cook Co., Aug., 1927, 3022 (SMS).

FRULLANIA BRITTONIAE Evans. Lairds Mills, Winona Co., May, 1890, *Holzinger* (UM); Winona, Beck's Place, June, 1890 (UM); Hat Point, Cook Co., Aug., 1902 (UM); Pine Lake, Aitkin Co., Aug., 1913, *Conklin* 1247 (SMS & YU); Hat Point, Grand Portage, Cook Co., Aug., 1927, 3120 (SMS).

FRULLANIA EBORACENSIS Gottsche. Lake Vermilion, St. Louis Co., July, 1886, *A. B. & H.* 44A, 29A (UM & NY); Wacouta, Goodhue Co., May, June, July, 1890, *Holzinger* 5, 3 (UM & NY); Bear Creek, Winona Co., June, 1890 (UM); Homer, June, 1890, 5 (UM & NY); Winona, May, June, Aug., 1890, 6 (NY); St. Croix Falls, Chisago Co., July, 1890; Marine Mills, Washington Co., July, 1890 (UM); Fond du Lac, St. Louis Co., June, 1891, *Cheney* 120A, 120B (NY & UW); Winona, Winona Co., April, 1894, *Holzinger* (UM); Taylors Falls, Chisago Co., Aug., 1896 (UM); Isle Lake of Woods, Lake of the Woods Co., July, 1896, *Conway MacMillan* (UM); U. S. Peninsula, Basswood Lake, Lake Co., June, 1897, *Holzinger* (UM); Fall Lake, June, 1897, 6 (UM & YU); Grand Marais, Cook Co., Aug., 1901, *MacM. L. & B.* 30, 245 (UM & YU); Portage between N. & S. Lakes, Aug., 1901, 139, 141, 144 (UM & YU); Stair Portage, Aug., 1901, 191 (UM & YU); Poplar River, Aug., 1901, 113 (UM & YU); Gunflint Lake, Aug., 1901, 38pp (UM & YU); Rosebush Falls, July, 1902, *Holzinger* (UM); Grand Marais, July to Aug., 1902 (UM & YU); Grand Portage Island, Aug., 1902 (UM & YU); Mt. Josephine, Aug., 1902 (UM); Old Iron Trail, Aug., July, 1902 (UM & YU); Little Devils Track Trail, July, 1902 (UM); Hat Point, Aug., 1902 (UM); Albert, Carlton Co., Aug., 1904, *Conklin* 402 (SMS); Lester River, St. Louis Co., Oct., 1906, 355 (SMS); Knife River, Lake Co., May, 1909, 829 (SMS); Collegeville, Stearns Co., July, 1910, *Rev. Jas. Hansen* 8 (SMS); French River, St. Louis Co., Sept., 1910, *Conklin* 2139 (SMS); Condon Park, Duluth, St. Louis Co., Aug. 6, 1911, 1665 (SMS); Lutsen, Cook Co., Sept., 1911, 1151 (SMS); Carlton, Carlton Co., Oct., 1911, 661, 1154 (SMS & YU); Pine Lake, Aitkin Co., Aug., 1913, 1146 (SMS); Bee, Houston Co., April, 1919, *Holzinger* (YU); Spring Grove, June, 1919, 3, 4pp (YU); Caledonia, July, 1919, 8 (YU); Red Wing, Goodhue Co., Aug., 1919, 10 (YU); Queen's Bluff, Winona Co., Aug., 1919 (YU); Red Wing, Goodhue Co., Sept., 1919, 24 (YU); Sept., 1919, 28, 29 (YU); Wacouta, Aug., 1919, 13 (YU); Bear Creek, Winona Co., May, 1924, *Holzinger* (UM & NY); Hungry Jack Lake, Cook Co., Aug., 1924, *Conklin* 2327, 2328 (SMS); Pigeon River, Sept., 1925, 2585 (SMS); Pine Island, Lake Vermilion, St. Louis Co., Sept., 1927, 3074 (SMS); Lake Minnetonka, Hennepin Co., July, 1928, *M. C. VanWert* H.35 (SMS).

FRULLANIA INFLATA Lehm. & Lindenb. Granite Falls, Yellow Medicine Co., July, 1901, *J. A. Andrew* 52 (SMS & YU); Grand Marais, Cook Co., July, 1901, *Holzinger* (UM); Carlton, Carlton Co., Oct., 1910, *Conklin* 995 (SMS), (C. C. Haynes Am. Hep. No. 94); Thompson, Oct., 1910, 2151 (SMS); Wacouta, Red Wing, Goodhue Co., Sept., 1919 (YU); Red Wing, Sept., 1919, *Holzinger* 26 (UM).

FRULLANIA OAKESIANA Aust. Gunflint Trail, Cook Co., July, 1901, *MacM. L. & B.* 114 (UM & YU); Little Devils Track Trail, July, 1902, *Holzinger* (UM & YU); French River, St. Louis Co., Aug., 1910, *Conklin* 1136, 1594 (SMS); Carlton, Carlton Co., Oct., 1910, 661, 956 (SMS & YU); Lutsen, Cook Co., Sept., 1911, 1141, 1143 (SMS & YU); Pine Island, Lake Vermilion, St. Louis Co., Sept., 1927, 3075 (SMS).

FRULLANIA RIPARIA Hampe. Minneapolis, Hennepin Co., Aug., 1888, *Underwood* (NY & YU); Winona, Winona Co., May, 1890, *Holzinger* (NY & UM) (listed as *F. dilatata*); Marine Mills, Washington Co., July, 1890 (UM); St. Croix Falls, Chisago Co., July, 1890; Taylors Falls, Aug., 1896 (UM); Winona, Winona Co., Sept., 1902 (UM & SMS); Collegeville, Stearns

Co., Nov., 1910, *Rev. Jas. Hansen* 18 (SMS); Pepsen Hill, Wabasha Co., May, 1919, *Holzinger* (YU); Cannon Falls, Goodhue Co., June, 1919, 39 (YU); Red Wing, July, 1919, 5 (YU); same location, Aug., 1919, 17 (YU); Aug., 1919, 22 (YU); Sept., 1919 (YU).

FRULLANIA SELWYNIANA Pears. Lutsen, Cook Co., Sept., 1911, *Conklin* 1140, 1133 (C. C. Haynes Am. Hep. No. 107) (SMS & YU); Two Island River, Lake Co., May, 1925, 2506, 2611 (SMS & YU).

LEJEUNEACEAE

COLOLEJEUNEA BIDDLECOMIAE (Aust.) Evans. Taylors Falls, Chisago Co., Aug., 1896, *Holzinger* (UM); Grand Marais, Cook Co., July, 1901 (UM); Carlton, Carlton Co., Sept., 1909, *Conklin* 663 (SMS); Thompson, Sept., 1911, 1224 (SMS).

LEJEUNA CAVIFOLIA (Ehrh.) Lindb. U. S. Peninsula, Basswood Lake, Lake Co., June, 1897, *Holzinger* 10 (UM & YU); Knife River, Aug., 1909, *Conklin* 547, 835, 856 (SMS & YU); Carlton, Carlton Co., Sept., 1909, 674 (SMS); Fairmount Park, Duluth, St. Louis Co., July, 1911, 1608 (SMS); Spirit Lake, Aug., 1911, 1632 (SMS); Lutsen, Cook Co., Sept., 1911, 1163 (SMS); Hungry Jack Lake, July, 1924, 2259 (SMS); Little Caribou River, Sept., 1925, 2646 (SMS); Pigeon River, Sept., 1925, 2584 (SMS).

PELLIACEAE

PELLIA EPIPHYLLA (L.) Corda. Lake Vermilion, St. Louis Co., July, 1886, *A. B. & H.* 175A (UM); Brule River (Arrowhead River), Cook Co., July, 1891, *Cheney* (UW); same location, July, 1891, *Cheney & F. F. Wood* 76 (NY & UW); Gunflint Lake, Cook Co., June, 1897, *Holzinger* (UM); Portage Island, June, 1897 (UM); U. S. Peninsula, Basswood Lake, June, 1897 (UM); Lutsen, Cook Co., Sept., 1911, *Conklin* 1185 (SMS); Cascade River, Sept., 1924, 2353 (SMS); Two Island River, Lake Co., May, 1925, 2607 (SMS).

PELLIA FABRONIANA Raddi. Lake Vermilion, St. Louis Co., July, 1886, *A. B. & H.* 173A. (NY); Hungry Jack Lake, Cook Co., Aug., 1924, *Conklin* 2340, 2335 (SMS).

PELLIA NEESIANA (Gottsche) Limpr. Fairmount Park, Duluth, St. Louis Co., July, 1911, *Conklin* 1108 (SMS); Lutsen, Cook Co., Sept., 1911, 1186 (SMS); Two Island River, Lake Co., May, 1925, 2505, 2599 (SMS).

BLASIACEAE

BLASIA PUSILLA L. St. Croix, Washington Co., July, 1890, *Holzinger* (UM); Chester Creek, Duluth, St. Louis Co., July, 1909, *Conklin* 873 (SMS); Collegeville, Stearns Co., April, 1910, *Rev. Jas. Hansen* 1 (SMS); French River, St. Louis Co., Sept., 1911, *Conklin* 1615 (SMS); Wahkon, Mille Lacs Co., Aug., 1913, 1248 (SMS); Spirit Lake, St. Louis Co., Aug., 1915, 1631 (SMS); Red Wing, Goodhue Co., Aug., 1919, *Holzinger* 20 (YU); La Crescent to Hokah, Houston Co., Oct., 1919, 33 (YU); Hat Point, Grand Portage, Cook Co., Aug., 1927, *Conklin* 3124 (SMS); Oneota, Duluth, St. Louis Co., Sept., 1927, 3052 (SMS).

METZGERIACEAE

METZGERIA CONJUGATA Lindb. Taylors Falls, Chisago Co., Aug., 1896, *Holzinger* (UM).

RICCARDIACEAE

RICCARDIA LATIFRONS Lindb. Grand Marais, Cook Co., June, 1891, *Cheney* (UW); Carlton, Carlton Co., Sept., 1909, *Conklin* 659 (SMS); French River, St. Louis Co., Sept., 1910, 2147 (SMS); Lutsen, Cook Co., Sept., 1911, 1184, 1171 (SMS); Nopeming, St. Louis Co., May, 1922, 1657 (SMS); Hungry Jack Lake, Cook Co., Aug., 1924, 2291 (SMS); Trail to Hungry Jack Lake, Sept., 1924, 2366 (SMS); Two Island River, Lake Co., May, 1925, 2600 (SMS); Pigeon River, Cook Co., Aug., 1927, 3077 (SMS).

RICCARDIA MULTIFIDA (L.) S. F. Gray, Lutsen, Cook Co., Sept., 1911, *Conklin* 2004, 1134 (SMS).

RICCARDIA PALMATA (Hedw.) Carruth. Carlton, Carlton Co., Oct., 1910, *Conklin* 1010 (SMS); Lutsen, Cook Co., Sept., 1911, 1200 (SMS); Hungry Jack Lake, Sept., 1924, 2290 (SMS).

RICCARDIA PINGUIS (L.) S. F. Gray. Collegeville, Stearns Co., April, 1910, *Rev. Jas. Hansen* 3 (SMS); Lutsen, Cook Co., Sept., 1911, *Conklin* 1184, 1194 (SMS); Hungry Jack Lake, Aug., 1925 (SMS); Hoveland, Sept., 1925, 2633 (SMS); Hat Point, Grand Portage, Aug., 1927, 3126 (SMS).

MARCHANTIACEAE

MARCHANTIA POLYMORPHA L. This species was reported by *I. A. Lapham* without locality or date in 1875. Bear Creek, Winona Co., Sept., 1884, *Holzinger* (UM); Lake Vermilion, St. Louis Co., July, 1886, *A. Bawett* (UM); same location, July, 1886, *A. B. & H.* 69B, 113B (UM); July, 1886, 113 (UM & UW); Winona, Winona Co., 1888, *Holzinger* (UM); Bear Creek, July, Aug., 1889 (UM); same location, June, 1889 (UM & NY); Beck's Place, July, 1889 (UM); Winona, July, 1890, 10 (NY); Minnehaha Falls, Hennepin Co., Aug. 1889, *L. M. Underwood* (NY); Homer, Winona Co., June, 1890, *Holzinger* (NY); Waconia, Carver Co., July, 1891, *C. A. Ballard* B.704 (UM); Clear Lake, Sherburne Co., June, 1891, *E. P. Sheldon* (UM); Iberia, Minn., July, 1891, 1033S (UM); Sleepy Eye, Brown Co., July, 1891, 1033 (UM); Moundbeck, Minn., Sept., 1901, *W. A. Wheeler* 1148 (UM); Queens Bluff, Winona Co., Oct., 1903, *Holzinger* (YU); Homer, July, 1906 (UM); Oneota, Duluth, St. Louis Co., Sept., 1909, *Conklin* 947 (SMS); Collegeville, Stearns Co., June, 1910, *Rev. Jas. Hansen* 4 (SMS); Fairmount Park, Duluth, July, 1911, *Conklin* 1564 (SMS); Condon Park, July, 1911, 1584 (SMS); Spirit Lake, Aug., 1911, 1643 (SMS); Lutsen, Cook Co., Sept., 1911, 1182, 1457 (SMS); Lamoille, Winona Co., *Holzinger*, Oct., 1919 (YU); Hungry Jack Lake, Cook Co., Aug., 1924, *Conklin* 2284 (SMS); Murday Creek, Anoka, Anoka Co., June, 1925, *M. C. VanWert* (SMS); Taylors Falls, Chisago Co., June, 1927, *M. C. VanWert* (SMS).

PREISSIA QUADRATA (Scop.) Nees. Winona, Winona Co., June, Aug., 1889, *Holzinger* 19 (NY); same location, May, 1890, 2 (NY); Homer, Winona Co., July, 1890 (UM); Lairds Springs, May, 1890 (UM); Lamoille, June, 1890, (UM); Marine Mills, Washington Co., July, 1890 (UM); Brule River (Arrowhead River), Cook Co., March, 1891, *F. F. Wood* (NY); same location, July, 1891, *L. S. Cheney* 85 (NY); Grand Marais, June, 1891, 37 (UW & NY); Ft. Snelling, Hennepin Co., April, 1901, *Daisy H. Howe*, 23 (UM); Stockton, Valley, Washington Co., July, 1906, *Holzinger* (UM); Homer, Winona Co., May, 1906 (UM); French River, St. Louis Co., May, 1911, *Conklin* 647, 1101 (SMS); Lutsen, Cook Co., Sept., 1911, 1181 (SMS); Red Wing, Goodhue Co., Aug., 1919, *Holzinger* 8, 23 (YU); Vasa, Goodhue Co., July, *L. N. T.* Nelson 1 (SMS & YU); Cascade River, Cook Co., Sept., 1924, *Conklin* 2347 (SMS); Two Island River, Lake Co., May, 1925, 2479, 2509 (SMS); Gooseberry River, July, 1925, 2626 (SMS); Pigeon River, Cook Co., Sept., 1925, 2594 (SMS); Oneota, Duluth, St. Louis Co., Sept., 1927, 3052 (SMS).

CONOCEPHALUM CONICUM (L.) Dumort. Lake Vermilion, St. Louis Co., July, 1886, *A. B. & H.* 100A (NY & UM); Minneapolis, Hennepin Co., Aug., 1888, *L. M. Underwood* (NY); Winona, Winona Co., 1888, *Holzinger* (UM); Bear Creek, June, 1889 (SMS & UM); same location, April, 1890, 59 (UM); Ramsey Co., May, 1891, *E. P. Sheldon* (UM); International Boundary, Cook Co., Sept., 1895, *MacMillan* 54; Minnehaha Falls, Hennepin Co., May, 1896, *Mrs. Lee* (YU); Big Spring, Vasa, Goodhue Co., July, 1903, *N. L. T. Nelson* 6 (YU); Belle Creek, Vasa, July, 1903, 23 (YU); Woodland, Duluth, St. Louis Co., May, 1909, *Conklin* 431 (SMS); French River, Oct., 1909, 649 (SMS); Collegeville, Stearns Co., April, 1910, *Rev. Jas. Hansen* 2 (SMS); Fairmount Park, Duluth, St. Louis Co., July, 1911, *Conklin* 1678 (SMS); Spirit Lake,

Aug., 1911, 1639 (SMS); Lutsen, Cook Co., Sept., 1911, 1180 (SMS); Hungry Jack Lake, Cook Co., July, 1924, 2255 (SMS); same location, Sept., 1924, 2337 (SMS); Two Island River, Lake Co., May, 1925, 2609 (SMS); Arrowhead River, Cook Co., Sept., 1925, 2565 (SMS).

REBOULIACEAE

REBOULIA HEMISPHAERICA (L.) Raddi. St. Paul, Ramsey Co., *I. A. Lapham* (UW); Bear Creek, Winona Co., June, 1889, *Holzinger* 20pp (UM) 39 (NY); Stockton, Winona Co., April, 1890 (UM); Winona, Winona Co., May, 1890 (NY & UM); Ft. Snelling, Hennepin Co., May, 1891, *E. P. Sheldon* (UM); Winona, Winona Co., May, 1893, *Holzinger* (YU & UM); Winona Bluffs, Winona Co., Nov., 1893 (UM); same location, Nov., 1893 (UM & YU); Stockton, Winona Co., May, 1901, Dr. Grout's exsiccatae (SMS); Lamoille, Winona Co., Aug., 1904, *Holzinger* (UM).

MANNIA FRAGRANS (Balb.) Frye & Clark. Lake Winona, Winona Co., June, 1888, *Holzinger* (UM); Winona, May, 1890, 18 (UM); May, 1890, 14 (NY); April, 1901 (UM); April, 1901, 2 (UM); Winona Bluffs, May, 1901, (UM); Granite Falls, Yellow Medicine Co., June, 1901 (UM); Winona Bluffs, Winona Co., March, April, 1905, *Holzinger* (UM); Stockton, May, 1906, (UM); Winona Bluffs, April, 1919 (YU); Ft. Snelling, Hennepin Co., May, 1927, *M. C. VanWert* (SMS).

MANNIA PILOSA (Hornem.) Frye & Clark. Jackson Park, Winona, Winona Co., May, 1905, *Holzinger* (UM & SMS); Caribou River at Falls, Lake Co., May, 1924, *Conklin* 2470 (SMS); same location, July, 1926, 2649 (SMS).

MANNIA RUPESTRIS (Nees) Frye & Clark. Winona, Winona Co., June, 1888, *Holzinger* (UM); Bear Creek, July, 1896 (NY); Stockton, July, 1906 (UM).

ASTERELLA LUDWIGII (Schwaegr.) Underw. Pigeon River, Cook Co., Sept., 1925, *Conklin & L. R. Wilson* 2487 (SMS); same location, July, 1926, *Conklin* 2648 (SMS).

ASTERELLA SACCATA (Wahlenb.) Evans. Winona Bluffs, Winona Co., May, 1901, *Holzinger* (SMS & UM); same location, May, 1917, 6 (SMS & UM). South Lake Winona, Winona Co., May, 1901, *Holzinger* (SMS).

RICCIACEAE

RICCIA FLUITANS L. Glencoe, McLeod Co., July, 1890, *T. J. McEllgett* (UM); Lake Minnetonka, Hennepin Co., July, 1882, *J. C. Arthur* (NY); Zumbrota, Goodhue Co., 1891, *C. A. Ballard* (UM); Lamoille, Winona Co., Oct., 1902, *Holzinger* (UM); Winona, Winona Co., Oct., 1904, *P. C. Meyer* (UM); same location, Oct., 1904, *Holzinger* (UM); Mississippi bottoms, Winona Co., Nov., 1906, (YU); Lake Shaffer, Hennepin Co., July, 1928, *M. C. VanWert* H. 34pp (SMS).

RICCIOCARPUS NATANS (L.) Corda. Winona, Winona Co., Oct., 1881, *Holzinger* (UM); same location, April, 1890 (NY & UM); Lake Minnetonka, Hennepin Co., July, 1882, *J. C. Arthur* (NY); Chaska, Carver Co., June, 1891, *C. A. Ballard* 62B (UM); Ely, St. Louis Co., Jan., 1891, *F. F. Wood* (NY); same location, Aug., 1891 (UW); Center City, Chisago Co., July, 1892, *B. C. Taylor* F. 1268 (UM); Collegeville, Stearns Co., July, 1901, *Rev. Jas. Hansen* 6 (SMS); Mississippi bottoms, Winona Co., Oct., 1903, *Holzinger* (SMS & UM); Maptoweda, Washington Co., June, 1904, *H. S. Lyon* 850 (UM); Mississippi bottoms, Winona Co., Oct., 1904, *Holzinger* (UM); same location, Nov., 1906 (YU); April, 1927 (UM); Lake Minnetonka, Hennepin Co., July, 1928, *M. C. VanWert* H. 34 (SMS).

ANTHOCEROTACEAE

NOTOTHYLAS ORBICULARIS (Schwein.) Sullivant. Mississippi River bottoms, Winona Co., Oct., 1902, *Holzinger* (SMS & UM).

ANTHOCEROS LAEVIS L. New Elm, Brown Co., July, 1899, *B. Fink* (UM); Courtland, Nicollet Co., July, 1899 (UM); Rainy Lake City, Koochiching Co., Aug., 1901 (UM); Lairds Spring, Winona Co., Aug., 1903, *Holzinger* (UM); Big Falls, Koochiching Co., July, 1905, *L. N. T. Nelson* (YU); Winona, Winona Co., July, 1906, *Holzinger* (UM); Collegeville, Stearns Co., Aug., 1910, *Rev. Jas. Hansen* 5 (SMS); Homer, Winona Co., Aug., 1917, *Holzinger* (SMS & C. C. Haynes Herb. YU); same location, Aug., 1918 (UM); Oct., 1919, 38 (YU).

ANTHOCEROS MACOUNII M. A. Howe. Mississippi River near Winona, Winona Co., Oct., 1903, *Holzinger* (UM); same location, Nov., 1906, 2 (NY & YU); Mississippi River, Winona Co., Oct., 1904, 444 (UM).

ANTHOCEROS PUNCTATUS L. New Elm, Brown Co., July, 1899, *B. Fink* (UM); det M. A. Howe; Courtland, Nicollet Co., July, 1899 (UM), det M. A. Howe; Granite Falls, Yellow Medicine Co., July, 1899 (UM).

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DISTRIBUTION OF TORTULA PAPILLOSA WILS.

IRMA SCHNOOBERGER

When identifying the mosses which I had collected during the winter of 1937, I was surprised and delighted to find *Tortula papillosa* Wils., which had not been reported from Michigan. This first collection was taken from an old elm tree above the Kalamazoo River, just inside the west city limits of Allegan. Later the species was found in Isabella, Gratiot, Montcalm, Ionia, Ottawa, and Van Buren counties by me, and in Washtenaw and Livingston counties by Dr. W. C. Steere. The discovery of these stations took a great deal of concentrated searching since *T. papillosa* seems to be common only locally.

Tortula papillosa has a very interesting world distribution. It is known in fruiting condition only from Tasmania (Dixon, 1924) and Australasia (Sim, 1926). Sterile specimens, usually bearing the characteristic multicellular propagula on the ventral side of the excurrent costa, have been reported from New Zealand (Dixon, 1923), the British Isles (Dixon, 1924), Europe (France (Husnot, 1884–90), Germany, Austria and Switzerland (Limpricht, 1890), Norway and Sweden (Monkemeyer, 1927), Italy (DeNotaris, 1869)), Africa (Sim, 1926), South America [Ecuador, Falkland Islands, Magellan (Cardot, 1901–1903)], and North America.

The distribution of *T. papillosa* in North America is well illustrated by the following specimens, which I have seen in several herbaria, notably the University of Michigan (M), The National Herbarium (N), the New York Botanical Garden (BG), Dr. A. J. Grout (G), and Mr. E. B. Bartram (B):

NOVA SCOTIA: Hunts Co., 1921, Bartram, Fernald, and Long, 744. (B) CALIFORNIA: "Hb Bolander legit. Mohr." (BG) CONNECTICUT: New Haven, J. A. Allen, 1879; W. A. Setchell, 1886; F. W. Chatterton, 1890: A. W. Evans, 1890: J. B. Lieberg, 1890; Hamden, G. E. Nichols, 1907. (BG) The following county records are given by Evans and Nichols (1908): Orange, Allen; Milford, Harger; Salisbury and Danbury, Nichols; Canterbury, Harger. GEORGIA: Athens, R. McVaugh and Pyron. Dr. Lewis E. Anderson (*in litt.*) says he identified this specimen, which is now in the University of Georgia herbarium. The collection made at Atlanta, Georgia, by J. K. Small (July 1, 1895) has been referred to *Tortula pagorum* by Dr. A. J. Grout (1904).

ILLINOIS: A collection without data is cited by S. M. Hague (1930). MASSACHUSETTS: Cambridge, J. K. Small, 1892; Readville, Britton & Kennedy, 1898; Amesbury, J. W. Huntington, 1903. (BG) NEW JERSEY: "Central New Jersey", C. F. Austin, 1870; Batsto, James & Lanning, 1852; Hoboken & Union, C. F. Austin, 1866. (BG) NEW YORK: Staten Island, W. T. Davis, 1890; Long Island, E. Brainard, 1867. (BG) OHIO: Green Township, Ross County, L. Pontius, 1936. (BG) PENNSYLVANIA: Washington County, Linn & Simonton, 1894. (B) A collection from "Blaire County, T. P. James" is cited by Jennings (1913). SOUTH CAROLINA: Charleston, J. D. Smith, 1877. (N) TENNESSEE: Greenville, Green County, L. E. Anderson. (Specimen in my herbarium).

In Grout's "Moss Flora," *T. papillosa* is reported from North Carolina. I have been unable to locate any specimen to verify this report and Dr. L. E. Anderson (*in litt.*) states that he has "looked for it repeatedly in North Carolina but has not been able to find it." He believes it is there but is "masked by the overabundance of *T. pagorum*."

T. papillosa is very easy to identify, even in the field, though at first glance it looks much like a sterile *Orthotrichum*, because of its dark green, closely imbricated leaves which are somewhat crisped-appearing when dry. But the costa has a characteristic shiny look utterly unlike an *Orthotrichum*, more like *Tortella fragilis*, though not so golden. The ever-present brood bodies, the excurrent costa, and the spatula-shaped leaves, all visible without a lens when the small plant is moistened, are very characteristic and unlike those of any other species.

The Michigan specimens have been found almost exclusively on elm trees. In Ottawa County it was found on hackberry and willow. However, in the eastern states it is reported from red cedars, maples, buttonwood, fallen ash, and limestone rocks; in France from poplar and linden, in Germany from *Ailanthus glandulosa*, and in Africa from oak. It has a tendency to grow on the exposed or sunny side of trees rather than on the shady side as do the species of *Orthotrichum*. It is usually found in open places near lakes or streams where it is assured of both light and moisture.

R. T. Wareham has noted that some of the collections of *T. papillosa* from Ohio contained *Lindbergia* and suggested the possibility of a close association of the two. Both are common on elms, but I often

find *Lindbergia* and no *Tortula* and *vice versa*. In Michigan I find that *Lindbergia* usually grows in more shaded situations than does *T. papillosa*.

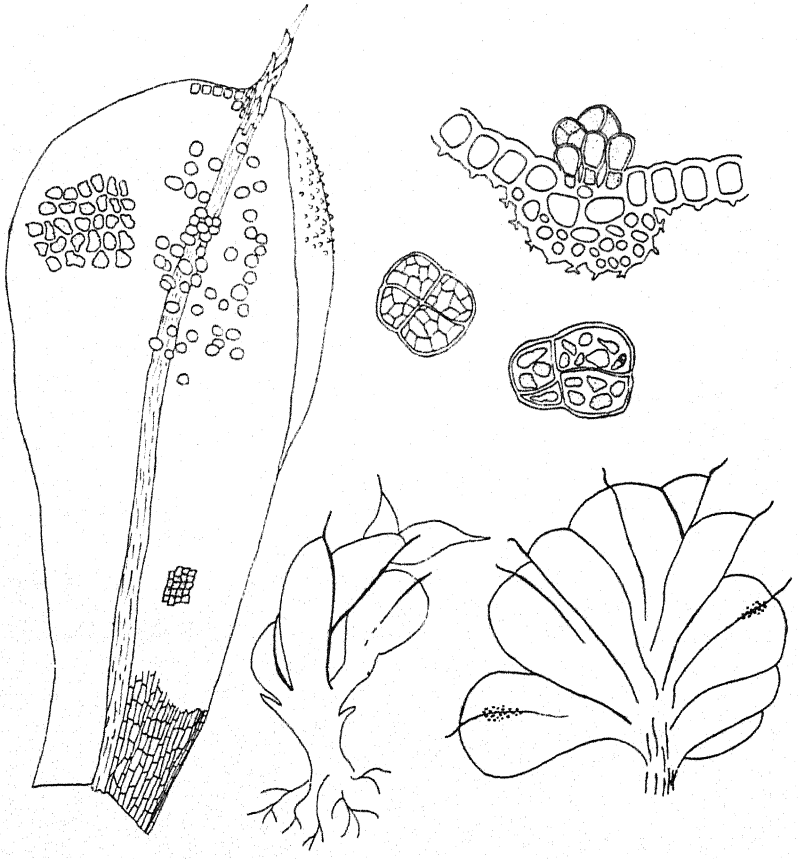

FIG. 1. TORTULA PAPILLOSA WILS.

The distinguishing microscopic details are the mammillate papillae on the dorsal side of the upper leaf cells, the fact that there is only one papilla on each cell, and the Y-shaped papillae on the back of the costa near the center of the leaf. Also the margin of the leaf near the apex becomes incurved in a very characteristic manner when the plant dries out. Limpricht's illustration (1890, page 679, Fig. 185) of a leaf section with brood bodies, reproduced in Grout's "Mosses with Hand-lens and Microscope" page 167, shows papillae on the

ventral side of the leaf cells as well as on the dorsal side. I can find no papillae on the ventral side of the cells in any of my Michigan material.

Since this species was collected in California it must have a much wider distribution throughout the western and central states. I am certain that collectors who search diligently will be rewarded by locating many new stations for this interesting species.

STILWELL JUNIOR HIGH SCHOOL, ALMA, MICHIGAN

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MULTIPLE SPOROPHYTES IN MNIUM AFFINE BLAND.

Growing at the edge of a small woodland pool six miles north of Seattle, Washington, a patch of *Mnium* was found which bore an unusually large number of young green sporophytes. From five to as many as eleven sporophytes per plant were counted in this particular area. A specimen sent Dr. A. J. Grout was pronounced *Mnium affine* Bland., "a very robust form with strongly decurrent leaves."

The specimens photographed (figure 1) were collected on April 1, 1940. Two weeks later, April 14, the same place was visited and only a few plants each with at most six sporophytes were found and these were beginning to turn yellow with age. However, upon close examination, other plants were discovered with the stubs of setae

numbering from seven to ten. It is probable that some small animal had eaten off the young sporophytes, utilizing the tender green capsules for food.—RUTH DOWELL SVIHLA, University of Washington, Seattle.

FIG. 1. MULTIPLE SPOROPHYTES IN MNIUM AFFINE.

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† SEVERIN RAPP. The well-known naturalist, Mr. Severin Rapp of Sanford, Florida, died October 19, 1941, from injuries inflicted by an automobile. He was especially noted for his collections of Florida bryophytes, of which several species have been named in his honor.—W. C. S.

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SPORE GERMINATION AND POLARITY IN PALLAVICINIA LYELLII

GORDON B. WOLCOTT

Polarity in the spores of Hepaticae has been described in *Pellia Fabroniana* by Showalter (1925). Wolfson (1928) described a similar condition in *Pellia epiphylla* and in *P. Necsiana*. In these plants a "basal cell" is apparently formed in the spore at the point of contact with the other spores of a quartet. The growing point of the new thallus is formed distal to the basal cell, and the axis of the thallus is determined, therefore, by the position of the spore in the quartet.

Lampa (1903) briefly described germination of the spores of *Blyttia Lyellii* Endl. This name is considered a synonym for *Pallavicinia Lyellii* (Hook.) Gray by Evans (1937). There are certain important differences between the present observations and those of Lampa.

Mature sporophytes of *Pallavicinia Lyellii* were collected near Milano, Texas, in March. The spores were sowed on various agar and liquid media. The best results were obtained from a culture on moist sand. Germination occurred about one month after sowing. Microscopic examinations were made of spores and sporelings in living condition and in aceto-carmine following fixation in Carnoy's fluid. All drawings were made with the aid of a camera lucida.

In the clone studied mature ungerminated spores were spherical and measured 22–24 μ in diameter (fig. 1). This agrees with the dimensions given by Frye and Clark (1937) for *P. Lyellii*. The nucleus is not visible in living spores. The spore walls have dense reticulate thickenings (fig. 22) except for a thin spot on which there are less dense thickenings which are not reticulate (fig. 23). This condition can be

seen clearly under oil immersion. The thin spot is found at the place of union of the members of a quartet of spores before complete cleavage. This is indicated by figures 25 and 26. Figure 25 shows a monad spore, that is, one in which cleavage did not take place in the spore-mother-cell, though the "spore" is mature, with fully formed reticulum. A diad spore, the result of one meiotic cleavage, is shown in figure 26. The dotted line indicates the position from which the detail was drawn. Diad and monad spores have been observed in nature in certain clones, and may also be produced artificially by the use of colchicine (Wolcott, 1941). The spore-mother-cell in *Pallavicinia* is deeply four-lobed prior to meiosis (Haupt, 1918, fig. 37). The formation of the reticulum on the spore wall is centripetal and occurs during meiosis. While the quartet of spores is still held together by the old wall of the spore-mother-cell a well-formed light reticulum may be seen over all of the *outer* face of a spore. The thin spot must, then, be formed on the remaining small *inner* portion. Thus the thin spot serves as a marker for the position of the spore in the quartet.

The first indication of germination is a swelling of the spore (fig. 2). The spores become greener. Nuclear division takes place and is completed before a cross wall can be seen. This is evident in aceto-carmine preparations (fig. 3). The first cross wall usually cuts across a portion of the thin spot dividing the spore cell into two unequal cells (fig. 4), with the smaller of the two cells toward the inner face of the spore, that is, toward the thin spot. The smaller of the two cells, which, because of later events, may be termed the initial cell, now increases in size and divides (figs. 5, 6). The larger of the two cells (the basal cell) does not usually undergo any further division, though some older sporelings may show a division (fig. 21). The increase in cell number and size of the sporeling is due to cell divisions in the cells derived from the initial cell and is shown in figures 7 to 21. At no time is there any indication of a germ tube. From the four-cell stage onward the cells are arranged in three dimensions. The first appearance of rhizoids (fig. 17) does not occur before 15 cells are formed. Rhizoids are formed by the elongation, at an angle to the body of the sporeling, of a single cell and the subsequent loss of chloroplasts in that cell. The position of the first rhizoid is variable but is usually toward the proximal end of the sporeling (fig. 19). The first slime papilla arises when the sporeling contains about 60 cells (fig. 20) and in older sporelings papillae may be seen along the margin.

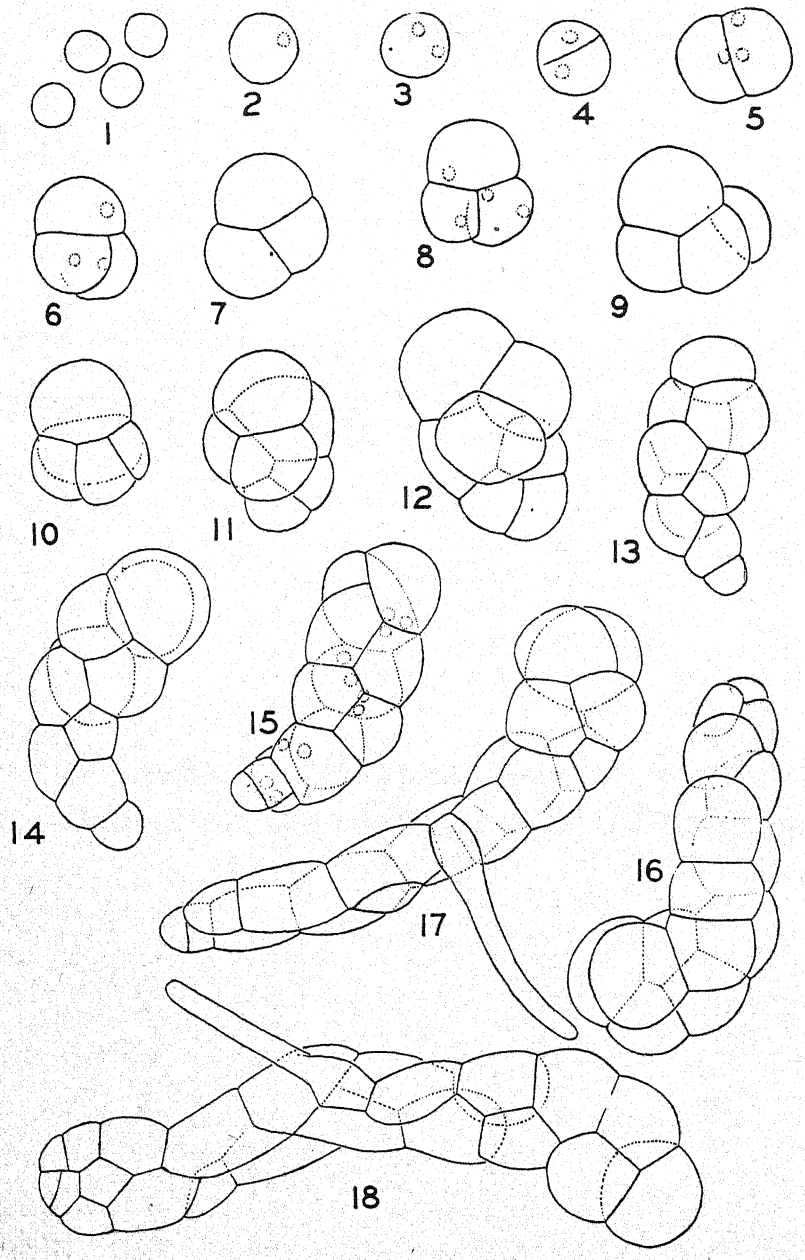
Changes in the spore wall are as follows: There is no rupture of the spore wall. The wall stretches as the cell increases in size and pieces of the reticulum become separated (fig. 24). This process has been described by Patterson (1933) in *Dumortiera hirsuta*. The reticulum is gradually distributed over the proximal 4–5 cells by subsequent cell division, the pieces being fewer toward the apical region. At one point, always on the basal cell, the reticulum does not become separated. This can be seen most clearly in later stages and is recognizable in sporelings with at least 60 cells (fig. 21). This affords a means of marking the basal cell, and therefore the outer portion of the spore, through development.

The exact time at which an apical cell is set aside is difficult to determine because of the dolabrate nature of the apical cell in *Pallavicinia* (Haupt, 1918). Figure 18, a sporeling of about 25 cells, shows two two-sided cells, either of which might be considered an apical cell. When the sporeling has as many as 45 cells a meristematic region, indicated by many small cells, is developed at the distal, or apical, end. In figures 19 and 20, a sporeling of about 60 cells, a true apical cell is not distinguishable, but the meristematic region is shown clearly. The distal end of the sporeling is one cell thick.

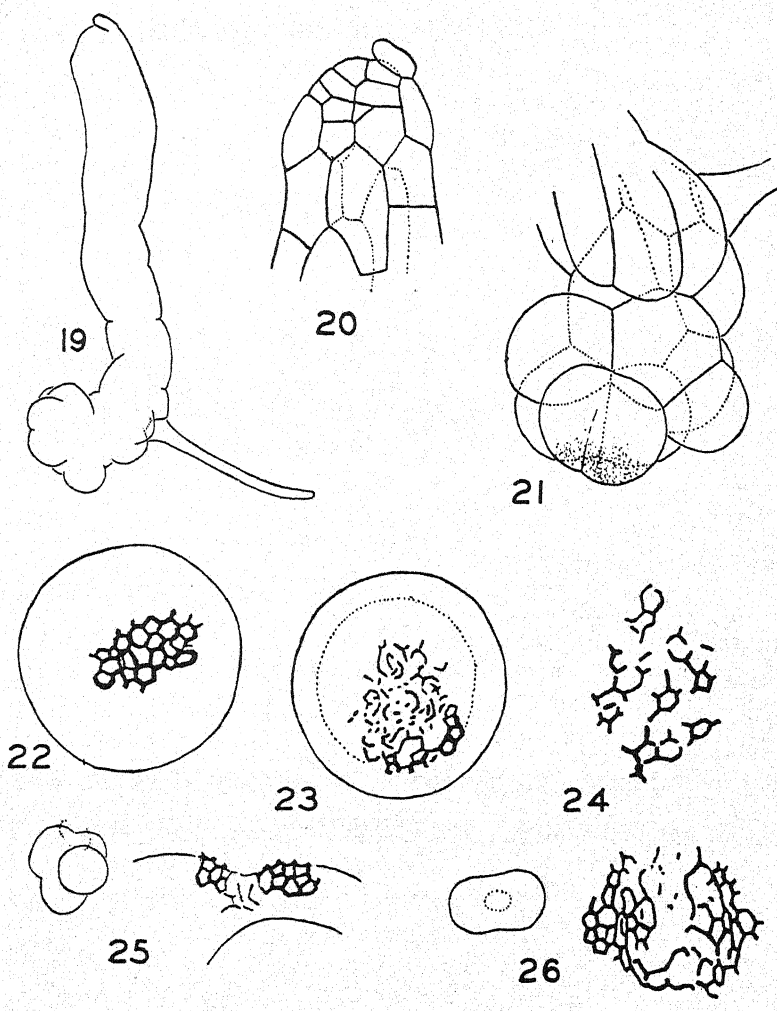
No sporelings were raised to maturity.

Lampa (1903) states that in *Pallavicinia Lyellii* (her *Blyttia Lyellii*) the embryo pushes itself out through an obvious ruptured place in the wall of the swollen spore, and that there are no divisions prior to this. In the material used in the present investigation there is no outpushing of an embryo, but rather the formation of a cell mass by repeated cell divisions. Further, the use of stains shows clearly that nuclear and cell division does occur while the spore is still round, though this is not evident in living material. The formation of the sporeling is, then, more nearly like that of *Pellia* and *Riccardia* (Showalter, 1925; Wolfson, 1928) than it is like that of other Anacrogynae.

The manner of cell formation in the germination of the spores of *Pallavicinia* indicate that there is a polarity in the spore cell which coincides with the position of the spore in the quartet, the inner surface being the future apical portion. This polarity, shown by the cutting off of the initial cell toward the thin spot in the first division of the spore and the subsequent formation of the cells of the sporeling from this cell, is similar to the polarity in the spores of *Pellia* as de-



FIGS. 1–18. PALLAVICINIA LYELLII.



Figures 1 to 26. *Pallavicinia Lyellii*. All figures × 260 unless otherwise indicated. All figures showing nuclei in cells are from material fixed in Carnoy's fluid and stained in aceto-carmine. Figures 22 and 26 also from fixed material. All other drawings are from living material. 1. Ungerminated spore. 2. Swelling prior to germination. 3. First nuclear division has occurred. 4. Two-celled stage with initial cell at top. 5. Nucleus of initial cell has divided. 6. to 18. Increase in cell number and rhizoid formation. 19. × 120. A sporeling of ca. 60 cells, with rhizoid and slime papilla. 20. × 260. Apical portion of sporeling shown in fig. 19. 21. × 260. Basal portion of sporeling shown in fig. 19. 22. and 23. × 1165. Two views of the same spore to show details of the reticulum. Fig. 23 shows the nature and extent of the thin spot. 24. × 1165. Detail drawing of reticulum from sporeling shown in fig. 5. Note separation of pieces of reticulum. 25. At left, a monad spore × 260. At right, detail drawing (× 1165) of reticulum from area indicated by dotted line. 26. At left, a diad spore × 260. At right, detail (× 1165) of reticulum from area indicated.

scribed by Showalter and Wolfson. There is one striking difference, viz., the axis is exactly reversed in that in *Pellia* the inner surface of a given spore is the basal portion and the outer surface becomes the apical portion. The time at which the polarity of the spores is determined is probably quartet formation since the axis of the spores may be correlated with the orientation of the spores in the quartets.

SUMMARY

1. By means of a thin spot in the dense reticulum on the walls of the spores of *Pallavicinia Lyellii* it is possible to locate, on any spore, the part which was directed inward when spore-mother-cell cleavage occurred.

2. The first division in the germination of the spores divides the cell into a basal cell and a smaller initial cell. The basal cell usually shows no further activity. The initial cell, by repeated cell divisions, gives rise to the sporeling. An apical meristematic region is formed when the sporeling consists of about 45 cells.

3. The initial cell is cut off toward the thin spot, i. e., toward the inner wall of the spore.

4. The position of the first cross wall in a given spore, and therefore the portion of the spore from which the sporeling will be formed, is determined by the polarity of the spore.

5. The polarity of the spore is probably determined at the time of spore-mother-cell cleavage.

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THE EFFECT OF WOUNDING, OF WOUND HORMONES AND OF GROWTH HORMONES ON RHIZOID FORMATION IN MOSSES AND LIVERWORTS.[1]

CARL D. LA RUE

It has been shown recently by the author[2] that wounding is a definite stimulus to root formation in the Spermatophytes. This has led to the question as to whether wounding stimulates rhizoid formation in the lower forms. Examination of one of his own earlier papers on regeneration in mosses[3] revealed a note that rhizoids were especially numerous near wounds. Following this lead experiments were made on several species of mosses with the results shown in Table I.

It is obvious that injuries caused by pricking and bruising exert a great stimulus to rhizoid formation. As one might expect in mosses the effect of any given wound is exerted only in the immediate vicinity of the wound. Thus the wounding of a stem causes rhizoid formation on that stem only, and wounding of a leaf produces rhizoids on that leaf only.

The wound hormone extracts used were made from leaves and stems of *Radicula aquatica,* a plant of great regenerative capacity. The strength of the hormone was unknown but on *Mnium cuspidatum* it produced a greater effect than the actual wounds. In the test with *Bryum bimum* the extract was concentrated to four times its normal strength but the result is questionable. Numerous experiments with other species gave evidence of the toxicity of the extract in the concentrations used. At the time these tests were made neither purified nor synthetic traumatic acid was available.

Both indole-acetic acid and indole-butyric acid exert a tremendous stimulus to rhizoid formation, and from the trials shown here indole-butyric acid is more effective than indole-acetic acid. However no claim is made here that the concentrations used were the most effective possible and more detailed experiments might give different results. The fact to be emphasized is simply that these growth hormones are as effective in producing rhizoids in mosses as in initiating roots in seed plants. This shows an additional physiological reaction common to rhizoids and true roots.

[1] Papers from the Dept. of Botany, Univ. of Michigan No. 726, reporting work done at the University of Michigan Biological Station.

[2] La Rue, C. D., The effects of wounding and wound hormones on root formation. Proc. Nat. Acad. Sci. 27: 388–392. 1941.

[3] La Rue, C. D., Regeneration in some American mosses. Papers Mich. Acad. Sci. Arts and Letters 13: 131–139. 1930.

Table I. Results of wounding and of treatment with growth hormones on rhizoid formation in mosses.

Species	Trial	Treatment	Number of leaves, or stems	Number of rhizoids, of leaves with rhizoids, or of stems with rhizoids
Mnium punctatum elatum	A	pinched with forceps	50 leaves	385 rhizoids
		crushed betweenglassslides	50 leaves	98 rhizoids
		1% indole-acetic acid in lanolin	50 leaves	175 rhizoids
		controls	50 leaves	1 rhizoid
Mnium punctatum elatum	B	wounded by pricking	25 leaves	112 rhizoids
		0.5% indole-butyric acid in lanolin	25 leaves	228 rhizoids
		0.5% indole-acetic acid in lanolin	25 leaves	158 rhizoids
		controls	25 leaves	34 rhizoids
Mnium punctatum elatum	C	wounded by bruising, leaves left on stems	25 stems	93 leaves on 25 stems had rhizoids
		wounded by pricking	25 stems	73 leaves on 19 stems had rhizoids
		2% indole-acetic acid in lanolin	25 stems	349 leaves on 25 stems had rhizoids
		controls	25 stems	23 leaves on 13 stems had rhizoids
Mnium affine	D	pricked and bruised	75 leaves	46 rhizoids
		controls	75 leaves	4 rhizoids
Mnium affine ciliare	E	leaves on stems pricked	30 leaves	280 rhizoids
		controls	30 leaves	77 rhizoids
Mnium affine ciliare	F	leaves bruised	25 stems	93 leaves with rhizoids on 25 stems
		leaves pricked	25 stems	73 leaves with rhizoids on 19 stems
		2% indole-acetic acid in lanolin	25 stems	349 leaves with rhizoids on 25 stems (number of rhizoids per leaf vastly greater than in other sets; stems completely covered with rhizoids)
		controls	25 stems	22 leaves with rhizoids on 13 stems
Mnium cuspidatum	G	leaves pricked and bruised	50 leaves	108 rhizoids
		wound hormone extract in lanolin	50 leaves	151 rhizoids
		controls	50 leaves	33 rhizoids

Bryum bimum	H	stems and leaves bruised	25 stems	736 rhizoids
		controls	25 stems	121 rhizoids
Bryum bimum	I	stems and leaves pricked and bruised	25 stems	20–30 rhizoids per stem
		1% indole-acetic acid in lanolin	25 stems	6–7 rhizoids per stem
		1% indole-butyric acid in lanolin	25 stems	rhizoids too numerous to count
		wound hormone extract	25 stems	5–6 rhizoids per stem
		controls	25 stems	4–5 rhizoids per stem
Rhodobryum roseum	J	leaves pricked	25 detached leaves	20 leaves had very numerous rhizoids
		0.5% indole-acetic acid in lanolin	25 detached leaves	16 leaves had very numerous rhizoids
		0.5% indole-butyric acid in lanolin	25 detached leaves	22 leaves had very numerous rhizoids
		controls	25 detached leaves	3 leaves had rhizoids which were much fewer than the preceding sets
Rhodobryum roseum	K	stems and leaves pricked and bruised	25 stems	22 plants had rhizoids
		0.5% indole-acetic acid in lanolin on stems and leaves	25 stems	23 plants had rhizoids
		0.5% indole-butyric acid on stems and leaves	25 stems	19 plants had rhizoids
		controls	25 stems	7 plants had rhizoids

All the tests summarized in Table I were made on gametophytes. As yet very little has been done with sporophytes to discover their reaction. It was noted that rhizoids arose rather frequently on setae at the places where these setae had been pinched by forceps in handling them but the trials made of the results of wounding on these organs were unsatisfactory because of the difficulty of securing sporophytes of proper species, and age at times when experiments could be made.

A trial with 1% indole-acetic acid gave decided results with sporophytes of *Dicranum undulatum*, *Pohlia nutans* and *Amblystegium* sp. Rhizoids were formed on detached sporophytes of all three species after a three-week period in water following the application of the hormone in lanolin on the sporophytes of *Amblystegium*. The effect was especially pronounced. Rhizoids were formed all over the sporo-

phytes, on both setae and capsules. On one capsule they emerged even between the peristome teeth.

Table II. The effects of wounding, and of growth hormones on rhizoid formation in *Conocephalum conicum*

Trial	Treatment	Number of tips	Number of tips which produced very numerous rhizoids
A	Each tip wounded with 50 needle pricks	50	45
	2% indole-butyric acid in lanolin	50	4
	2% indole-acetic acid in lanolin	50	11
	Controls (untreated)	50	20
B	Each tip wounded with 50 needle pricks	100	54
	0.5% indole-butyric acid in lanolin	100	31
	0.5% indole-acetic acid in lanolin	100	98
	Controls (untreated)	100	12

TRIALS WITH LIVERWORTS

The liverworts are more difficult to use in experiments of the sort here described because all the forms which are large enough to handle conveniently produce rhizoids so readily that it is difficult if not impossible to tell whether or not a few more were produced as a result of the experimental treatment. The most suitable subject for experimentation seemed to be *Conocephalum conicum*. Tips of this species which had not yet developed rhizoids on their under surfaces were cut off, and laid on moist filter paper in damp chambers. Some of these tips developed great numbers of rhizoids, others very few or none during the experiments. Thus separation could be made into two groups on the basis of numbers of rhizoids produced even though these were too numerous to count. The results of the experiments are shown in Table II.

In trial A of the tests with *Conocephalum* it was evident that the hormone was too concentrated, and had caused great injury. In trial B when a concentration of 0.5% was used instead of one of 2% there was less evidence of toxicity though even at 0.5% concentration indole-butyric acid caused the death of about one-third of all the tips to which it was applied. This may account for the relatively slight effect of this hormone shown in Table II as compared with that secured by the use of indole-acetic acid.

SUMMARY

1. Wounding, application of wound hormones, and of growth hormones all stimulate rhizoid formation in mosses.

2. In one species of liverwort, *Conocephalum conicum*, wounding, indole-acetic acid, and indole-butyric acid increase the numbers of rhizoids formed.

LYELLIA IN THE UNITED STATES

L. R. STANFORD

On November 8, 1941, a trip was made into the Cascade Mountains of Washington to collect bryophytes. Collections were made near Big Four Inn, about Lat. 48° 9′ N., Long. 121° 30′ W., elevation 1900 feet. A trail three-fourths of a mile long reaches an elevation of approximately 2100 feet at the base of a high mountain. Above the end of the trail the mountain rises perhaps 2000 feet at an angle of 55 degrees; so that winter snows slide down and pile up like a talus slope at the foot of a cliff. Some of the resultant ice remains throughout the year and in summer cools the surrounding atmosphere. Since the slope is so steep that deep snow cannot cling to it, rocks and their dirt-filled crevices are left free in summer.

Within 150 yards of the glacier, amid numerous other bryophytes and some scrubby bushes, occurred a moss, unfortunately sterile, which proved to be of more than ordinary interest. It is *Lyellia Lescurii* (James) Frye, originally described from Alaska but later reported from Kamchatka, Japan, and Swanson Bay in British Columbia. The most southerly location previously recorded is Swanson Bay, about 200 miles north of the northern end of Vancouver Island and about 85 miles southeast of Alaska.

The discovery of *Lyellia Lescurii* in Washington extends the known geographical range of the species some 450 miles farther southeast, and for the first time into the United States. At Swanson Bay it was collected within a few feet of sea level, and at Big Four Inn it occurs at 2100 feet, so one may expect to find it even farther south but at considerably higher elevations.

Lyellia Lescurii is not a striking plant and is apt to be overlooked by anyone not knowing bryophytes well. It can easily be recognized under a microscope by the serrate lamellae on the upper side of the leaf and the presence of a few cilia on the upper edge of the sheath.

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NORTHERN MOSSES IN NEW ZEALAND

G. O. K. SAINSBURY

One of the most interesting features of the moss flora of New Zealand is the representation there of a number of genera and species which, according to our present knowledge, are otherwise confined to the northern hemisphere. The qualification is of importance because, to mention Australasia first, bryological research on the Australian continent has been so desultory that it is impossible to estimate the probability of any future discovery. The predominance of Australian species both in Tasmania and New Zealand, due of course to the ancient land connections, makes it likely that future research will show some Australian extension of the distribution of these northern mosses. On the other hand it must be remembered that the New Zealand flora is a very distinct one, in many respects sharply cut off from that of Australia, and that so far as Tasmania is concerned there is less likelihood of the mosses in question having been overlooked, because there has been, proportionately to the size of the country, far more collecting done there than in Australia. Of the other parts of the southern hemisphere in which an extension of the distribution might be expected, South America is certainly indicated as the most likely region. The southwestern part of the continent has strong floristic affinities with New Zealand, and the antarctic land connection between the two countries appears to have been the bridge by which most of the northern mosses reached the antipodes.

The subjoined list is of those that are confined to New Zealand, and also of a few other mosses whose distribution in this connection deserves notice. The information given as to the general distribution is derived from the *Musci* of Brotherus (2nd Edition), but details of countries and regions are omitted and the relative continents only are usually mentioned in the list. Unless individual mention is made to the contrary the species in question has been found in fruiting condition.

SAELANIA GLAUCESCENS (Hedw.) Broth.—Europe, Asia, North America and Hawaii. The only finding in New Zealand was some 40 years ago on Mt. Ida, in the central southern region of the South Island, at 920 M.

SELIGERIA Bry. Eur.—Europe, Asia and North America. The two New Zealand species are sub-montane (at ca. 600 M.) and grow on

calcareous rock. One, *S. Cardotii* R. Br. ter., is fairly common in the South Island, but has only been found once in the North Island. The first and only finding of the other, *S. diminuta* (R. Br. ter.) Dixon, was at Castle Hill, Canterbury, South Island. Both species are very minute, and an extension of the distribution of *S. Cardotii* will probably be established as the result of further research. This is less likely however in the case of *S. diminuta*, because Castle Hill already has a moss and a phanerogam which are endemic to its very restricted area.

EUCLADIUM Bry. Eur.—Europe, Asia and North America. The New Zealand species, *E. irroratum* (Mitt.) Par., is not uncommon in both islands on wet calcareous rock. It has been found at an altitude of ca. 600 M. but generally speaking it is a moss of the lowlands.

HYMENOSTYLIUM CURVIROSTRE (Ehrh.) Lindb. The plant from Otago, South Island, that was formerly supposed to belong here is however *Anoectangium Bellii* Broth.

CROSSIDIUM Jur.—Europe, Asia, North America and Peru. The Peruvian species are of course technically of the southern hemisphere. The New Zealand *C. Geheebii* (Broth.) Broth. is near the European *C. chloronotos* (Brid.) Jur., but there are differences which are probably specific. The only specified station is Napier, North Island, the scene of a disastrous earthquake in 1931. There is reason to suppose that other unspecified early findings are also referable to Napier, where the moss was rediscovered recently on limestone boulders near the sea. Within the last century Napier was an island, though it is now completely joined to the mainland by earthquake upheaval and artificial reclamation. *C. Gebeebii* is a tiny moss, and may well have been overlooked in similar stations.

COSCINODON Spreng.—Europe, Asia, North America and Bolivia. The Bolivian species are found on the high Andes, and must rank technically as southern mosses. The New Zealand species, which has not yet been published, was found on stones in a damp open place on Mt. Cassidy, Arthur's Pass, Canterbury, South Island, at 1400 M., associated with *Andreaea* sp.

CLIMACIUM DENDROIDES (Hedw.) Web. & Mohr.—Europe, Asia, Japan and North America. This appears in the *Musci* as *C. novae-seelandiae* C. M. It is confined to the South Island, where it has been found in a few high and mountainous parts, and never in fruit. As is the case with the northern plant its habitat is marshy ground.

BRACHYTHECIUM ALBICANS B. & S.—Europe, Caucasus and North America. A recent finding on rock at De la Beche, Tasman Glacier (1500 M.) in a remote part of the Southern Alps establishes it as indigenous. Otherwise it has been collected in a few North Island localities, but always in association with introduced pasture grasses, and under circumstances throwing strong doubt on its native status. Fruit has not been found in New Zealand.

EURHYCHIUM PRAELONGUM Hobk.—Europe, Asia, North America, Japan, Madeira, etc. Collected in several localities in both islands, and appears to be indigenous, though in some of its stations it has probably been introduced. Barren.

LEPTODON SMITHII (Dicks.) Mohr. Has a wide distribution in the southern hemisphere, extending to South America and South Africa, as well as to Australia and New Zealand. It is noticed here because of the remarkable fact that it does not occur in North America. Most of the northern mosses confined to New Zealand would appear to have found their way south through the North American continent, but *L. Smithii* must have reached this country, as well as South America, along some other path.

PYLAISIA Bruch & Schimp.—Europe, Asia, Japan and North America. The New Zealand species, *P. australis* Dix. & Sainsb., was discovered some years ago in Marlborough, South Island, and has not been found since. The plant was sterile.

HYLOCOMIUM SPLENDENS B. & S.—Europe, Asia, Japan, North Africa, Canary Islands etc., North America. Although only discovered in New Zealand in recent years, this species has been found to have a wide distribution in the central and eastern mountain range of the North Island, where it has been found in several localities growing in abundance at the top of the range, an altitude of ca. 1500 M. So far it has not been reported in the South Island, and no fruiting plants have been found.

BUXBAUMIA APHYLLA Hedw.—Europe, Asia, Japan and North America. Has been found at Atiamuri, in the central volcanic part of the North Island, in moss-covered pumice ground amongst indigenous scrub; and also at Kaingaroa, not far distant, on the bases of introduced trees, such as larch and pine.

POLYTRICHUM GRACILE Menz.—Europe, Asia, Japan and North America. There is only one New Zealand record—from Canterbury, South Island—where it was collected many years ago.

P. FORMOSUM Hedw.—Europe, North Africa, Madeira, Caucasus, Syria, Japan and North America. After being found twice in recent years in mountainous parts of the South Island, this species was again collected in a similar region in the North Island. Since commencing this article I have received the species from yet another locality in the South Island, and I think that further findings in suitable localities are quite probable.

It will be seen that of the eight northern species in the above list which are confined to New Zealand one half have never been found fruiting in that country, and further that these are all pleurocarpous mosses, whilst the fertile species are all acrocarpous. It would however be rash to assume that these pleurocarps, with the exception perhaps of *Hylocomium splendens*, are normally barren in New Zealand, because systematic collecting has been far too scanty to warrant any such general conclusion.

LICHENS FROM MOUNT SHASTA, CALIFORNIA

ALBERT W. HERRE

Mount Shasta is a recent volcano of the Lower Cascade Range in Northern California, at the head of the Sacramento Valley. It is believed to be the youngest of the Cascade peaks, and therefore the youngest of the large mountains in the continental United States. Although it has a height of 14,161 feet it has the fewest species of any large mountain in our country.

Mr. William Bridge Cooke has collected and studied the plants of Mount Shasta during the past five years, and has published a Flora of Mount Shasta, and supplement. He has also written on the ferns and life zones of Mt. Shasta. No one in the past seems to have collected lichens on Mount Shasta, but during July and August, 1941, Mr. Cooke made a small collection of lichens, which I have identified.

The same physical conditions which have prevented a rich and varied flora of flowering plants from developing on this great peak of mainly andesite lavas also cause it to be poor in species of the more conspicuous foliose and fruticose lichens. At the same time one must remember that lichens have only been collected incidentally, and over a limited area of the mountain. The 37 species here listed should at least be trebled, when the mountain has been fully explored. Mr.

Cooke did not get lichens above 9500 feet, and many additions should be obtained from the higher elevations.

VERRUCARIACEAE

VERRUCARIA NIGRESCENS Persoon. Abundant on smooth rocks in swiftly flowing spring water at 8000 feet.

PYRENULACEAE

MICROTHELIA ATERRIMA (Anzi) A. Zahlbr.

PELTIGERACEAE

PELTIGERA PULVERULENTA (Taylor) Nylander. Specimens scanty and poor. Moist places in the Sisson Southern Trail spring, at 6500 feet.

LECIDIACEAE

LECIDEA ATRO-BRUNNEA (Ram.) Schaerer. Abundant.

LECIDEA CAULOPHYLLA (Tuck.) A. Zahlbr. Only one specimen obtained.

LECIDEA FUSCO-ATRA (L.) Ach. Very common.

LECIDEA LURIDELLA Tuck. One specimen.

LECIDEA POLYCARPA Floerke. One specimen; spores $\frac{3.5–6.2}{9.3–12.5}$ μ.

LECIDEA RUBIFORMIS (Wahl.) Hooker.

RHIZOCARPON DISPORUM (Naegeli) Müller of Argau.

RHIZOCARPON GEOGRAPHICUM (L.) Lam. and DC. Common.

RHIZOCARPON LECANORINUM (Koerber) Anders.

RHIZOCARPON PETRAEUM (Wulfen) Massalongo. Spores $\frac{11.5–12.5}{23–31}$ μ.

CLADONIACEAE

CLADONIA FIMBRIATA (L.) E. Fr. var. SIMPLEX (Weiss) Flotow.

GYROPHORACEAE

GYROPHORA ARCTICA Ach.

GYROPHORA DECUSSATA (Vill.) A. Zahlbr.

GYROPHORA HIRSUTA Ach. The Gyrophoras obtained seem to be common, but are mostly small and poorly developed. Undoubtedly several more species occur on the peak.

ACAROSPORACEAE

ACAROSPORA FLAVA (Bell.) Trevis. Common and conspicuous.

ACAROSPORA RUFESCENS (Smith) Bausch. Abundant.

LECANORACEAE

LECANORA ALPINA Sommerfelt. Fine specimens.

LECANORA CINEREO-RUFESCENS (Ach.) Nyl. Occurring in tiny, inconspicuous patches. Spores $\frac{5\text{–}6.5}{6.5\text{–}12}$ μ, subglobose to ovoid.

LECANORA COILOCARPA (Ach.) Nyl. Common.

LECANORA CONTORTA (Hoffm.) Stiz. Specimens sterile.

LECANORA MELANOPHTHALMA (Lam. and DC.) Ramond.

LECANORA MURALIS (Schreb.) Rabenh. Abundant and variable, passing into variety *diffracta* (Ach.).

LECANORA PACIFICA Tuckerman. Abundant on twigs and branches of *Abies magnifica* var. *shastensis*, at 7000 to 8000 feet.

LECANORA POLYTROPA (Ehrh.) Rabenh. Abundant on rocks, the thallus usually disappearing. Spores $\frac{3.5\text{–}6.2}{9.3\text{–}12.5}$ μ.

LECANORA RUBINA (Vill.) Ach. At times very finely developed.

CANDELARIELLA VITELLINA (Ehrh.) Müll.-Arg. Occurs sparingly on rocks, mixed with other lichens.

PARMELIACEAE

PARMELIA ENTEROMORPHA Ach. Abundant on branches of *Abies concolor* and *Abies magnifica* var. *shastensis* at 6000 feet.

PARMELIA OLIVACEA (L.) Ach. Abundant on *Cercocarpus ledifolius* at 5500 feet, on the north side of Shastina, above Hotlum station.

PARMELIA PUBESCENS (L.) Wainio. Occurring in small inconspicuous patches on rocks.

NEPHROMOPSIS PLATYPHYLLA (Tuck.) Herre. Abundant on Shasta fir, at 6000 feet. Interspersed with it is *Alectoria oregana*.

USNEACEAE

LETHARIA VULPINA (L.) Wainio. Very common on *Abies*, along with *Parmelia enteromorpha* and Alectorias, at 6000 to 7500 feet. It is also abundant on *Pinus albicaulis* at 8000 feet, on the northwest side of Shastina.

ALECTORIA JUBATA (L.) Ach. Occurring in dense masses on *Abies*, at 7000 to 7500 feet.

ALECTORIA OREGANA Nyl. Interspersed with *Parmelia enteromorpha* and *Letharia vulpina*, and common on branches of *Abies*, at 6000 to 7500 feet.

CALOPLACEAE

CALOPLACA FERRUGINEA (Huds.) Th. Fr. var. FESTIVA (Fries). Spores $\frac{4\text{–}5}{9\text{–}11}$ μ. Occurs sparingly amid other lichens.

STANFORD UNIVERSITY, CALIFORNIA.

THE FORAY OF 1941

HENRY S. CONARD

The Foray for 1941 opened on the evening of September 2 at Natural Bridge State Park, Powell County, Kentucky. During the three days of the Foray a total of 13 persons took part. As usual, some were present for only one or two excursions. The tours were planned, and splendidly carried out, by Dr. Margaret Fulford and Mr. H. T. Shacklette, both of whom know the country and the species to be expected. However, 30 new records of distribution were recorded for the counties visited, and five new records were made for the state.

The headquarters hotel, Hemlock Lodge, is reached only by foot-path, a hundred yards amongst big boulders up a mossy woodland trail from the railway station and the end of an excellent auto road. The hotel offers simple accommodations, but amply comfortable, with excellent meals and luncheons, and friendly atmosphere.

The region is a fragment of the Cumberland Plateau, cut by deep, extremely tortuous and branching canyons until only narrow strips of the capstone of Pottsville Conglomerate remain. We saw three places where adjacent canyons have come together below the cap-stone, leaving natural bridges along the skyline. The valleys are more than 500 feet deep, and occasionally wide enough at the bottom to warrant clearing and cultivation. Most of the area is timbered. With a high precipitation, the valleys steam in the summer sun. Every shaded rock is moss covered, and mosses grow on the trees far above the ground. Beneath the capstone are sandstones and lime-stones, with many overhangs and actual caverns, and numerous waterfalls. Of trees, we recall beech, tulip, cucumber, oaks, hemlock, pines, sugar and red maple. The first tour was up the trail to *the* natural bridge. On the bridge, *Polytrichum piliferum* was collected at the only known locality in the state. In an overhang-cave just below the bridge on the south, *Bryoxiphium* was found. This usually rare moss was found on every suitable ledge we visited, often in great abundance, but never in fruit. After lunch at the bridge we wandered along a narrow, winding, level remnant of the plateau, and then down a trail, past mosses and more mosses, to the hotel.

The second tour led to another valley, where an auto road passes through a tunnel to the dripping north side of a ridge. Several hours

were spent among the boulders, caves and falls of a small stream. Here *Bryoxiphium, Hookeria acutifolia, Dumortiera hirsuta,* and rare filmy ferns were collected, along with many commoner things. Continuing to Sky Bridge, most of the party crossed to see the end of the hogback. For some the bridge was too high and narrow to cross.

The third tour was to "Tight Holler" (Hollow), called tight because the walls all around are so high and precipitous that until recently one could get in only by means of crude improvised ladders, or by a walk of some miles up the creek. We descended rapidly by a "roadway," and wandered for hours in the canyon. The creekbed was covered in places with *Fontinalis novae-angliae,* in tattered condition. Rocky overhangs were covered with *Bryoxiphium.* The lovely climbing fern, *Lygodium palmatum,* grows by thousands along the bottom. The most beautiful bed of *Sphagnum* I ever saw lay along the creek bank. Emerging from the "Holler," we said goodbye and started on our separate ways.

To the writer, in addition to the species named above, it was a joy to meet out of doors *Fissidens osmundioides, Campylopus* sp., *Dicranodontium denudatum, Dicranum condensatum, D. fulvum, D. spurium, D. viride, Syrrhopodon texanus, Trichostomum cylindricum, Sciaromium Lescurii, Leptodon ohioensis, Scmatophyllum marylandicum,* and *S. carolinianum.*

Dr. Fulford supplied a mimeographed list of the mosses of Kentucky, which was a great help to all. Apparently 95 species of mosses were recognized and 39 hepatics, giving a grand total of 134 species. The evenings were spent in discussions about classification and distribution of mosses and phylogeny of plants in general, in personal anecdotes and reminiscence, and in listening to Mr. Shacklette's inimitable rendering of Kentucky mountain ballads by voice and accordion. If only every member could attend a Foray!

GRINNELL COLLEGE, GRINNELL, IOWA

REVIEW

GROUT, A. J. North American Musci Perfecti Nos. 401–425; Newfane, Vt., September 1941.—The latest issue of Grout's exsiccati includes the usual variety of mosses from widely separated stations. Some of the species are uncommon and others from new and extended ranges are worthy of special mention. The southwestern range of *Entodon cladorrhizans* is extended to Capitan Mountain in New

Mexico. The first and only known locality in the United States for *Syrrhopodon prolifer* is in Florida. The first fruiting specimens of *Anacolia laevisphaeria* distributed from the United States come from Campo, California, which is also a northwestern extension of the known range. Formerly it was known only in southern Arizona. The northwestern range of *Husnotiella torquescens* is extended to the region near Jamestown, California. It was formerly known to extend in this country from Texas to Arizona. *Bryum miniatum* was recollected in Yosemite National Park, California, the type locality. *Syrrhopodon incompletus* rarely fruits in the United States, but a few well-fruited specimens come from Florida. *Pyramidula tetragona* is uncommon and comes from Lincoln, Nebraska, which is about the center of its known distribution in this country. *Dicranella cerviculata* var. *americana* was collected in Maine near the type locality. *Physcomitrium Kellermanii* var. *Drummondii* and *P. Hookeri* are widely distributed but rather rare. Both were collected near Lincoln, Nebraska.

A curious specimen of unknown identity is included. It may be *Acaulon* or *Phascum* but the capsules contain very large spore-like bodies that are said to be possibly spores of an infesting fungus. However, upon crushing them the outer shell and contents resemble the eggs of some small invertebrate, possibly an insect.

The following collectors contributed to this issue: Gilford Ikenberry, Hollis Koster, Irma Schnooberger, Faith Pennebaker Mackaness, Walter Kiener, L. E. Anderson, Inez M. Haring, Ruth Schornherst, E. A. Moxley, D. C. Adams, McAllister, and A. J. Grout.

The complete series is as follows: 401. *Bryum caespiticium* Hedw., Vt.; 402. *Sphagnum subsecundum* Nees *forma*, Vt.; 403. *Sphagnum magellanicum* Brid., Vt.; 404. *Husnotiella torquescens* (Card.) Bartr., Cal.; 405. *Bryum miniatum* Lesq., Cal; 406. *Entodon cladorrhizans* (Hedw.) C. Müll. *forma*, N. Mex.; 407. *Orthotrichum stellatum* (Brid.) Brid., N.J.; 408. *Dichelyma capillaceum* Bryol. Eur., Mich.; 409. *Weisia viridula* Hedw. var. *australis* Sull., La.; 410. *Pyramidula tetragona* (Brid.) Brid., Neb.; 411. *Tetraplodon pennsylvanicus* (Brid.) Sayre, Ga.; 412. *Syrrhopodon incompletus* Schwaegr., Fla.; 413. *Astomum ludovicianum* Sull., La.; 414. *Desmatodon plinthobius* Sull. & Lesq., La.; 415. *Leskea australis* Sharp, La.; 416. *Pterigoneurum subsessile* (Brid.) Jur., Ariz.; 417. *Syrrhopodon prolifer* Schwaegr., Fla.; 418. *Mnium marginatum* P. Beauv., Ont.; 419. *Dicranella cerviculata* var. *americana* Grout, Me.; 420. *Didymodon rigidulus* Hedw., Ont.; 421. *Acaulon* or *Phascum*, Tex.; 422. *Tortula inermis* (Brid.) Mont., Cal.; 423. *Anacolia laevisphaera* (Taylor) Flowers, Cal.; 424. *Physcomitrium Hookeri* Hampe, Neb.; 425. *Physcomitrium Kellermani* E. G. Britton var. *Drummondii* (E. G. B.) Grout, Neb.—SEVILLE FLOWERS, University of Utah.

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THE GEMMALING OF RIELLA AMERICANA II.

R. A. STUDHALTER AND MARTHA ENNA COX

I. INTRODUCTION

A previous paper (12) under the above title gave an account of the developmental stages of the American ruffle plant, *Riella americana*, from the time of the dehiscence of the gemma to the maturity in the gemmaling of the juvenile structures—the rhizoidal lobe, the pillar or column, and the growth lobe. The major literature on the gemmaling of the genus *Riella* was also reviewed. The present paper continues the account with emphasis on the differentiation of some of the structures belonging to the adult plant and the fate of the juvenile structures. The differentiation of some of these organs begins before the juvenile structures have reached their maximum development; their discussion has, however, been postponed to the present paper in order to maintain a more logical sequence.

In the stages reported herein, there are pronounced similarities between the gemmaling and the sporeling. Only few specimens of the later stages of the sporeling had been available for observation, nad only one of them reached the stage in which the axis and the wing were differentiated (7). Gemmalings, on the other hand, have been available in abundance in all stages, so that it is possible to give for the gemmaling many details of structures and stages which had been only rarely seen in the sporeling.

II. DIFFERENTIATION OF STRUCTURES BELONGING TO ADULT PLANT

The structures of the adult plant which receive emphasis are secondary rhizoids, axis, lateral outgrowth, permanent intercalary growing point, and wing.

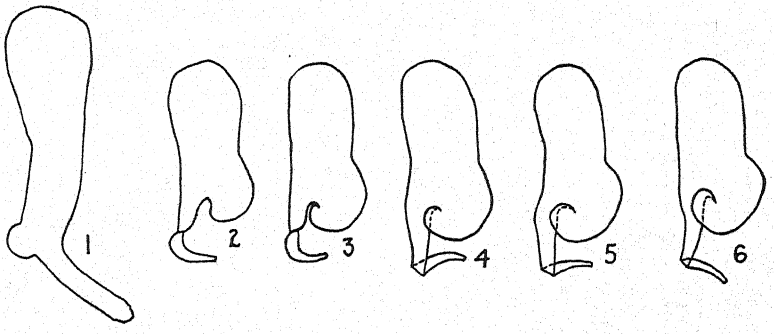
Secondary rhizoids.—The origin and development of rhizoids in liverworts has been discussed by Goebel (5) and by Buch (3). Vraber (13) discussed rhizoids in *Riella;* his figure 99 is excellent for a young stage of rhizoid formation in *R. helicophylla.*

It has been seen (12) that the first rhizoids to be formed on the gemmaling, namely the primary rhizoids, are outgrowths of differentiated cells in the rhizoidal lobe. Secondary rhizoids, on the other hand, arise from a different structure, are not derivatives of specialized cells, and are not definitely localized in position. They take their origin from various undifferentiated cells in several parts of the pillar, appearing on either or both sides of this nearly vertical structure.

The first secondary rhizoids are usually seen when the column has a length of 12 or 14 short cells. They appear from cells near the base of the pillar, and later ones arise in acropetal succession from points progressively higher on the column. In the end they may be seen at any altitudinal zone of the pillar except its very top, where the cells are associated with the lateral outgrowth. None seems to originate from the rhizoidal lobe or the growth lobe, although much later they arise in abundance from the axis. The total number of secondary rhizoids in the mature tennis racquet stage ranges up to at least 40. They may reach a length of at least 6 mm. and are a material aid to the primary rhizoids in anchoring an increasingly heavier superstructure.

Almost any cell of the pillar may be involved in the formation of secondary rhizoids, but they usually come from cells in the second or third row from either margin. The cell giving rise to a secondary rhizoid is at first not different from other cells of the pillar (fig. 7). Just preceding rhizoid formation, such a cell loses its chloroplasts and becomes densely cytoplasmic. The details of bulging, nuclear migration, and oil drop formation are nearly identical with those occurring during the development of the primary rhizoids of the gemmaling (12) and of secondary rhizoids in the sporeling (7). From the former they differ mainly at the junction of the tube with the mother cell for, regardless of the shape of the cell, the secondary rhizoid grows outward from a rounded area of nearly the same diameter as that of the rhizoid. This diameter is essentially the same as that of all other rhizoids in *R. americana;* it averages 20 to 25 μ, with a range of 15 to 30 μ.

All rhizoids, both primary and secondary, are smooth and show no tendency whatever toward pegging. The wall at the dome-shaped tip is very much thickened (fig. 8), and the mature structure lacks protoplasm. No cross walls have been observed in any rhizoids on the gemmaling. On very rare occasions the secondary rhizoids have a short club-shaped tip with a diameter twice that of the main body of the tube. Also in very rare instances they are forked a short distance back from the tip, the branching being nearly dichotomous (fig. 9). Regardless of the position of the pillar, the rhizoids are positively geotropic.



Figs. 1–6. RIELLA AMERICANA. × 12. Rhizoids are omitted in all figures. 1. Gemmaling with a young lateral outgrowth; rhizoidal lobe and lower part of pillar disintegrated; portion of pillar shown, 15 cells long and 9 cells wide; growth lobe 75 cells long and 23 cells wide at middle horizontal zone. 2–6. Various stages of the lateral outgrowth of the same gemmaling in culture; growth at first downward, then inward toward pillar, which it presently overlaps, and finally upwards; rhizoidal lobe and base of pillar disintegrated; pillar 8 to 10 cells wide; growth lobe 35 cells long and 26 cells wide at middle; 2, February 23; 3, March 2; 4, March 6; 5, March 9; and 6, March 11.

Differentiation of axis.—Due to the meagerness of available material, very few details had been observed on the method of differentiation of the axis in the sporeling (7). It was clear, however, that the axis arose on the lateral outgrowth, which is a new structure belonging to the adult plant. In the gemmaling, on the other hand, the axis is differentiated from the upper lateral part of the pillar, which is a juvenile structure, even though a similar lateral outgrowth is also produced.

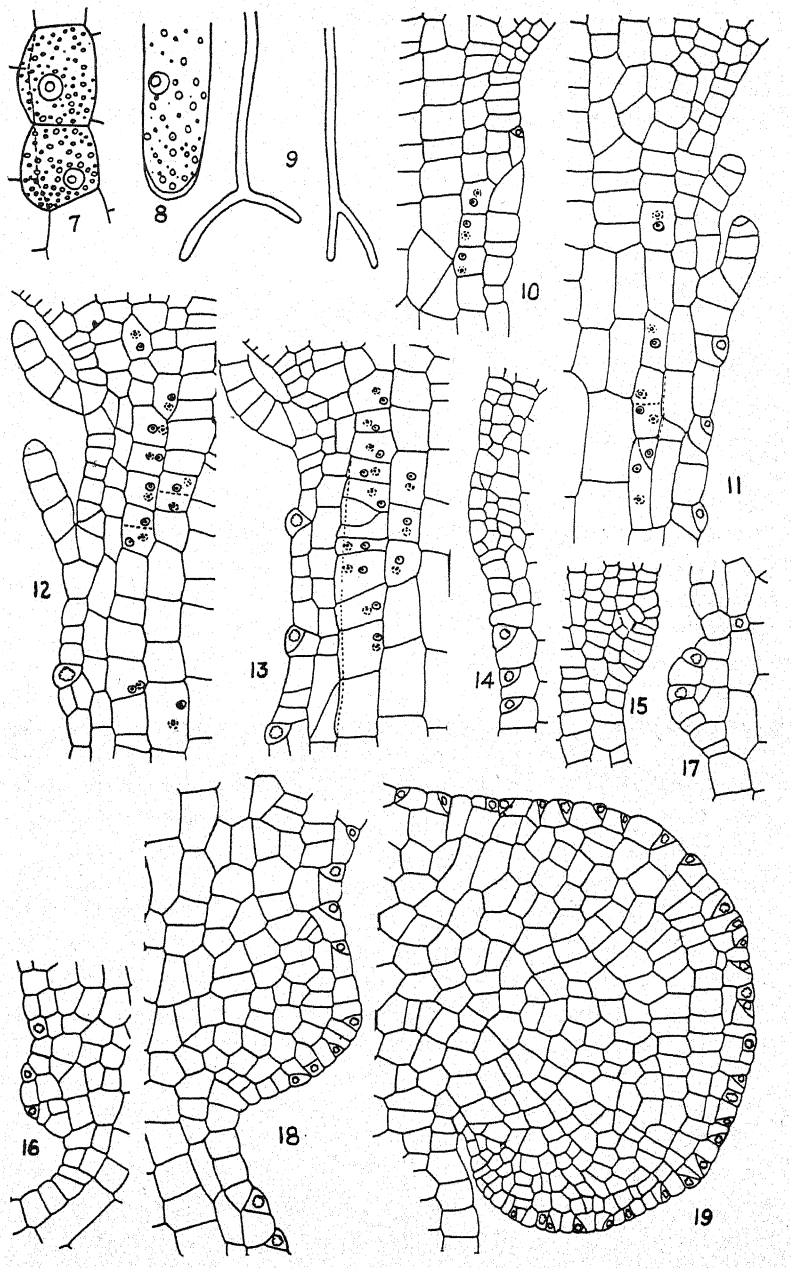
During the development of the column, cell division has been largely in one plane, with only a few divisions in a perpendicular plane. The result is an enormously lengthened pillar which shows very little widening and no thickening; it remains a single cell in

thickness throughout. Some time before the column has reached its maximum length, cell divisions in the third plane, perpendicular to the other two, become evident at certain localized points. This represents the first time in the entire developmental history of gemma and gemmaling that divisions occur in the third plane and that thickening results. The patches of such division are localized near the upper end of the pillar, usually in the second or third row from the margin on either side (figs. 10, 11); they have not been observed in the outermost row nor in the middle vertical zone. A patch may involve a single cell or two or three cells in a vertical row.

The first cross wall is formed in the plane of the pillar, so that in face view of the column there may be no evidence of division other than the presence of two nuclei at different optical levels. When one of the two derivative cells divides again to form a wall across the column while its sister cell fails to divide, the facts of thickening are more clearly in evidence (figs. 11, 12). Presently the cells between the isolated patches divide similarly, and a vertical row of double cells is formed which extends from just below the top of the column downwards. This thickened structure is the beginning of the permanent axis of the adult *Riella* plant.

Soon, adjacent cells in the row next removed from the margin (third or fourth row) divide in a similar manner (figs. 12, 13), and presently cells in next adjacent rows do likewise, thereby broadening the axis toward the middle vertical line of the pillar. At the same

Figs. 7–19. RIELLA AMERICANA. Figs. 7 to 8 and 10 to 19, × 230; fig. 9, × 54. Mucilage is shown diagrammatically by a wavy line. 7. Two cells near margin of pillar showing very early stages of bulging to form secondary rhizoids; chloroplasts disintegrating. 8. Tip of secondary rhizoid showing nucleus, oil drops, and thickened end wall. 9. Rare instances of nearly dichotomous branching of secondary rhizoids. 10. Early stage in formation of axis; 3 adjacent cells in the second row from the margin of the pillar have divided to form two nuclei and a cross wall in the plane of the drawing; nuclei in solid lines are in an upper optical plane and nuclei in dotted lines in a lower. 11. Slightly later stage in axis formation; 4 cells have divided to form two nuclei each and a cross wall in the plane of the drawing; in one instance the lower of the two cells has divided again to form two nuclei and a wall (dotted) across the axis, while its sister cell at the upper optical level has not yet divided. 12. Slightly later stage in axis formation, involving also cells from the adjacent row. 13. Involvement of still more cells to form the axis. 14. Very early stage in formation of lateral outgrowth; pillar below, growth lobe above. 15. Slightly later stage. 16. Stage a little older than the preceding, showing the first marginal mucilage cells in outgrowth. 17. Slightly older stage. 18. Still older stage. 19. Lateral outgrowth (wing) approaching its maturity, showing arrangement and relative sizes of the cells and location of residual meristematic cells (permanent intercalary growing zone) at junction of outgrowth and pillar.



Figs. 7–19. RIELLA AMERICANA. × 12.

time the wave of thickening proceeds further down the column in regular basipetal succession. Simultaneously, in the region of the first thickening, further cell divisions in the third plane are responsible for further thickening of the axis. Walls are now shifted, divisions ensue irregularly, and the axis becomes broadly oval in cross section. The marginal row of the pillar does not become involved. Ultimately the primary axis forms an unbroken thickened structure in the side of the pillar, extending from very close to its top downwards to its very base (12, fig. 6). The added rigidity thus furnished helps materially in maintaining the vertical position in the now top-heavy gemmaling.

In width the primary axis remains relatively narrow. Its normal width is 3 to 5 cells and its thickness 3. These are less than half the dimensions attained by the secondary axis, to be formed later. The primary axis is oval in cross section.

All of the cells of the axis are short. While the other cells of the pillar elongate, those of the axis often divide instead, so that they are for a time only half as long as the adjacent cells, or even shorter. In a similar manner their width remains the same as formerly, or it may become less by cell division. Ultimately, however, when the gemmaling grows into a mature plant, the cells of the primary axis elongate considerably; those near its top may become 7 times as long as wide, while the length of those near its middle may be 2½ times their width. Their width remains practically constant. All of the cells contain chloroplasts.

An axis is usually differentiated on only one margin of the pillar. Occasionally, however, each margin differentiates an axis independently and simultaneously; in such cases, twin plants result.

Lateral outgrowth.—The formation and activities of the lateral intercalary meristematic zone have been worked out in fair detail in the sporeling of the American ruffle plant (7), in which the lateral outgrowth takes its origin from the intercalary meristematic cells at one side of the primary thallus and ultimately differentiates into both axis and wing. In the gemmaling, on the other hand, in which the axis is differentiated in the pillar, the intercalary meristematic zone forms a lateral outgrowth which ultimately produces only the wing.

Simultaneously with the thickening to form the axis in the pillar of the gemmaling, the meristematic cells located at the base of the growth lobe take on a pronounced activity. The first divisions occur in

marginal cells of the growth lobe, just above its junction with the pillar (fig. 14). The new cross walls are parallel with the margin, and with their enlargement they extend the margin outwards (figs. 15, 16). Similar divisions take place in the cells of the marginal row further removed from the pillar (fig. 17), extending the zone involved. The new cells just formed, as well as others adjacent to them further from the margin, also divide. Activity is rather rapid and soon several dozen small cells (fig. 18) are involved in the formation of a new structure called the lateral outgrowth, which remains one cell in thickness and maintains its position in the plane of the growth lobe and pillar.

All of the cells thus formed are at first small. Those in the marginal row are often smaller than those in the interior. The smallest cells and those which retain their meristematic capacity to the greatest extent are usually those of the marginal row at or very near a lower corner of the growth lobe. For a time the newly formed cells, which are light green in color, occur in rows "parallel" with the margin; at one stage there may be as many as four or five such parallel rows. Soon, however, the cells (except those in the marginal row) become irregular in size, shape, and arrangement. Cross walls may now be formed in any plane through a line perpendicular to the surface of the growth lobe.

The total number of cells in the lateral outgrowth increases steadily until it reaches several hundred (fig. 19). Except for size and meristematic capacity, they are more or less similar, and they soon become a darker green. The marginal mucilage cells are formed early in the development of the lateral outgrowth and may be first seen when the latter contains only five or six new cells. They increase in number as the outgrowth enlarges and may reach a total of several dozen. Rarely do they occur closer than five or six cells from the junction of the growth lobe with the pillar, the nearest ones being often 10 to 12 cells removed.

The margin of the outgrowth at first forms a shallow, widely sweeping arc (fig. 1). Later it becomes nearly semi-circular, and in the course of time it takes on a very nearly circular form. The direction of growth and extension is at first 90 degrees with the margin of the cuneate base, that is, it is generally downward at an angle of about 45 degrees with the median line of the growth lobe and pillar (figs. 1, 2, 15, 18). With the continued formation of new cells and the en-

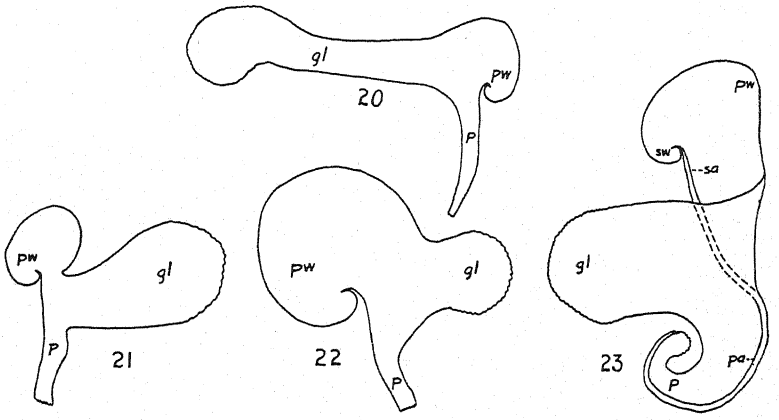
largement of those further removed from the base of the lobe, the orientation of the most meristematic cells is shifted so that the direction of their further outward growth is more nearly downward, and later inward toward the pillar (fig. 3). The lateral outgrowth often overlaps the pillar, and it may finally grow both inward and upward (figs. 5, 6), the direction of growth having shifted through an arc of 180 degrees or more. More frequently, however, overlapping of lateral outgrowth and pillar is not as extensive as that shown in figures 4 to 6. Throughout its development, the lateral outgrowth remains uniformly one cell in thickness and maintains its position in the same plane as the growth lobe and column.

The number of lateral outgrowths is correlated with the number of axes which are being differentiated in the pillar. When there is only one axis, there is only one lateral outgrowth, and this is formed from the meristematic cells directly above the axis. When two axes are being formed, one on each side of the pillar, two lateral outgrowths are produced, one above each axis, and twin plants result. Twinning is, however, much less common than the formation of single adult plants. Nothing is known of the physiological factors (hormones?) governing the correlation between axis and lateral outgrowth.

That there are somewhat similar outgrowths originating from lateral meristems in other groups of plants is indicated by work cited by Bower (1, p. 276; 2, p. 437) for two genera of ferns.

Permanent intercalary growing point.—In the early stages of development, both pillar and growth lobe of the gemmaling are composed of meristematic cells throughout. We have seen that in the pillar there is an acropetal wave of cell elongation which leaves only a few cells at the top in a meristematic condition. In the growth lobe there is a similar and simultaneous basipetal wave of cell enlargement, leaving meristematic cells at its base. These two regions of residual meristematic cells overlap; they are in fact a single region. Still later the cells in the middle vertical zone at the junction of the growth lobe and pillar also become enlarged, and generally also those at one side. In the latter case, a single small region of meristematic cells remains along one margin, at the point of union of the growth lobe and pillar, and lying directly between the newly formed axis and lateral outgrowth. This small residual group of undifferentiated cells becomes the single permanent growing point of the *Riella* plant (fig. 19). Its intercalary position is of significance. Most of the important struc-

tures of the adult plant take their origin from this small group of cells. They remain not only meristematic, but also definitely chlorophyllous, although their color is a lighter green than that of adjacent cells.



Figs. 20–23. RIELLA AMERICANA. × 12. Rhizoids omitted in all figures. 20. Gemmaling with laterally displaced growth lobe (in early stages of resorption), small primary wing, and a portion of the pillar. 21. Same with end of growth lobe completely resorbed and wing larger. 22. Later stage with a large part of growth lobe resorbed and wing still larger. 23. Young plant with remains of pillar, partly resorbed growth bobe with broad base, primary axis, secondary axis, and primary and secondary portions of wing. *gl*, growth lobe; *p*, pillar; *pa*, primary axis; *pw*, primary part of wing; *sa*, secondary axis; *sw*, secondary portion of wing.

The wing.—The entire lateral outgrowth can now be considered as the primary wing of the ruffle plant. It already has the position typical for this organ at the top and to one side of the thickened axis, separated from the latter by the permanent intercalary growing point. And it already has the shape and structure of the wing. Since the entire lateral outgrowth of the gemmaling becomes the wing, it may seem superfluous to use the term lateral outgrowth at all. It will be recalled, however, that in the sporeling the lateral outgrowth gave rise to axis and permanent growing point, in addition to the wing. It seems advisable, then, to retain the term for the sake of comparison.

III. FATE OF JUVENILE STRUCTURES

The juvenile structures of the *Riella* gemmaling prove to be temporary structures as well. Rhizoidal lobe, pillar, and growth lobe serve their purpose for a time, play their part in developing more permanent

organs, and then pass out of the picture. They are best interpreted as vestigial structures, comparable to their homologues in the sporeling (8).

Rhizoidal lobe.—The marginal cells of the rhizoidal lobe begin to lose their chloroplasts shortly after dehiscence of the gemma, with the development of primary rhizoids. The chloroplasts become reddish and disentegrate. The cytoplasm becomes granular and the entire protoplasm decomposes. This process progresses slowly inwards from the margin toward the rhizoidal initials. In many instances there is a breakdown of the walls of the involved cells, and the mucilage in the marginal mucilage cells usually disappears before the walls decompose. This process is interpreted as resorption, the usable materials being passed on to the rapidly growing primary rhizoids and the rapidly elongating pillar. Resorption is, however, a slow process. By the time all of the juvenile structures of the gemmaling are mature, the outer half of the lobe has usually been resorbed. In general, resorption is not as complete as in the growth lobe, since the cell walls and even some of the mucilage in the marginal mucilage cells are often left intact. Ultimately, however, the entire lobe disintegrates, and it is not infrequent to find a mature tennis racquet stage of the gemmaling with the rhizoidal lobe completely decomposed. In any event, with the further formation of structures belonging to the adult plant, the rhizoidal lobe nearly always disintegrates completely.

The papillose mucilage cell, which had already lost its color, disintegrates early.

The column.—As secondary rhizoids are formed at progressively higher levels on the pillar, the lower portion of this structure also frequently loses its color and disintegrates (figs. 1 to 6, 20 to 23). Mature plants, therefore, are anchored mainly by tertiary rhizoids extending into the soil from the axis.

The growth lobe.—As the lateral outgrowth increases in size, the old growth lobe is bent sharply at its base (fig. 1). It maintains its general shape and remains in the same plane, but it swings gradually away from the vertical and finally stands at right angles to the median line of the pillar, on the side opposite the lateral outgrowth (fig. 20). In the case of two lateral outgrowths on the same gemmaling, the growth lobe becomes folded and more or less crumpled between them.

Disintegration of the lobe begins shortly after the lateral outgrowth

is formed. It is evident first in the most distal cells and proceeds in basipetal sucession. The cellular details of decay are identical with those described for the primary thallus of the sporeling (7) and involve discoloration and disintegration of the chloroplasts, breakdown and disappearance of the protoplasm, separation of cells from one another, and finally decomposition of the cell walls. The mucilage in the mucilage cells often disappears before the walls are resorbed.

The process is interpreted in the same way as it was in the sporeling, that is, as a resorption and passing on of usable materials to the rapidly developing lateral outgrowth. The former attachment cell of the gemma, when present, decays as the wave of decomposition reaches it. The decomposed margin of the lobe has a ragged, torn appearance. Ultimately nearly the entire lobe is decomposed, only a few of its cells at the top of the pillar being left to bridge the rear edge of the wing with the unthickened part of the pillar (figs. 20 to 23). Only a few instances were seen in which resorption and decay were materially delayed.

As the gemmaling grows into a mature plant and new structures are added on top of the pillar, the small cells of the base of the displaced growth lobe enlarge to keep pace with the tensions created by the new structures, and new cells are added by division. The base of the growth lobe, formerly cuneate, now assumes the opposite shape, flaring out to a much broadened structure (figs. 20, 22, 23).

The fate of the growth lobe has received little attention by other writers. Displacement of the primary thallus of the sporeling (the homologue of the growth lobe of the gemmaling) was figured by Goebel (4). Porsild (6) figured the same and called attention to its dead cells. The same is done for another specimen (his figure 5D) which may be either a gemmaling or a sporeling. Studhalter (7) apparently first used the term resorption in connection with the sporeling. Wigglesworth (14) failed to find resorption or decay in the primary thallus of *R. capensis*. The present paper seems to be the first to discuss the phenomenon as definitely present in the gemmaling as opposed to the sporeling.

IV. GEMMALING TO MATURE PLANT

Description of immature adult plant.—With the laying down of the major vegetative structures of the adult plant and the decay of part of the juvenile structures, we may consider that the plant has passed

the gemmaling stage and is now an immature adult. It may now be composed of a half dozen major parts—the remains of two or three juvenile organs and the beginnings of three structures of the adult (fig. 23).

The rhizoidal lobe, if not completely decayed, remains as a colorless, partly resorbed structure still anchored by its dead primary rhizoids. The pillar, usually decomposed at its base, otherwise remains a light green structure firmly attached to the substrate by its secondary rhizoids (from the pillar proper) and by a few tertiary rhizoids (from the axis). It is surmounted by the meager remains of the growth lobe, still green in part and having a ragged margin at the end opposite the growing point.

Of the new structures, the green primary axis has reached its maximum size. The first of the tertiary rhizoids are already present. It is surmounted by the permanent intercalary growing point, now ready to add to axis and wing, and to deposit scales, gemmae, and sex organs. The cells of the growing point, also, are chlorophyll-bearing; in mass they have a light green color. The green primary wing with its odd shape resembling the headdress of an Indian (8), has also reached its maturity.

In this stage (fig. 23) the over-all length of the immature adult may be over 7 mm., of which the remains of the pillar and the axis may be 2½ to 3 mm. long, and the wing 4½ to 5 mm. long and 1 to 1¾ mm. wide. The pillar is a little wider, even at its base, than its progenitor, the isthmus; it ranges from 0.15 to 0.2 mm. at the base to 0.9 mm. at its top. Some of the increase in width, which is mostly at the top, has taken place during its final stages of development.

At this stage there are two methods of distinguishing a gemmaling from a sporeling: first, the position of the axis (on pillar or lateral outgrowth); and second, the presence of the rhizoidal lobe or the empty spore wall, neither of which is likely to remain attached to this stage of maturity. Otherwise gemmaling and sporeling of *R. americana* are identical at the mature tennis racquet stage.

Growth to mature plant.—Growth to maturity is induced mainly by the activity of the permanent intercalary growing point. These cells are directly or indirectly responsible for the formation of the secondary axis, laid down on top of the primary; for the secondary wing, deposited below the primary; for the formation of lateral leaf scales, ventral scales, and gemmae; and for the antherids and archegones. Tertiary rhizoids, some of which have been present for some

time, are formed in acropetal succession from the primary and secondary parts of the axis.

Rather early in the development of the lateral outgrowth, the first ventral scales are formed in the upper portion of the column (12, figs. 4, 6). They may sometimes be seen even before the differentiation of the axis. They bend upwards toward the growing point (figs. 11, 12, 13), to which they give some protection. In single plants they are found only on one margin, while in double plants they occur on both margins. These first ventral scales grow in the same plane as the gemmaling until they broaden. In the study of the sporeling (7) the first ventral scales were not recognized as such, but were merely called trichomic outgrowths.

Previous papers have described the development of the ventral scales originating from the axis (11), of lateral leaf scales (10), and of gemmae (9). A future paper will consider the activities of the permanent lateral intercalary growing point.

Fate of perched gemmalings.—The ultimate fate of those gemmalings which in nature develop while they are entangled in the parent ruffle plants is not clear. Some of them undoubtedly extend their rhizoids into the soil, become anchored, and develop more or less normally. This would be particularly true in the case of injury to and the falling down of the plants supporting them, and might easily happen when they are loosened and washed away by currents of water. Since tertiary rhizoids can be formed from the axis at almost any altitudinal zone, such plants can presumably become established in the substrate when any part of the axis makes contact.

V. SYMMETRY

Symmetry in the gemmaling is not so varied as in the sporeling (7, 8). The tennis racquet stage shows a simple bilateral symmetry. The immature and adult plants have no symmetry at all, as viewed from the side; but a modified bilateral symmetry is in evidence on the two sides of a plane cutting the axis in half and extending out through the middle of the wing, cutting this structure into two equal halves, each a half cell in thickness. In the case of twin plants, there is a false simple bilateral symmetry.

Dorsiventrality has also changed. In the gemma one would consider the outer face dorsal and the inner face, at which it was attached, ventral. Since the axis of the gemmaling thickens at one side of the column (also on one side with reference to the original gemma), the

dorsiventral relations shift around the long axis of the gemmaling by 90 degrees. One of the margins, which had been considered the side, now becomes the ventral face of the axis, while other points have shifted to correspond.

The above terminology has been substituted (7) for the "Profilstellung" of Goebel (5), concerning which there had been much discussion at the beginning of the present century.

SUMMARY

In the later developmental stages of the gemmaling of the American ruffle plant, *Riella americana*, secondary rhizoids develop from the column (pillar). The primary axis is differentiatied along one edge of the pillar by local thickening which progresses basipetally. A lateral outgrowth, which develops from the base of the growth lobe just above the axis, becomes the primary wing. Cells located between axis and wing are the only cells of the gemmaling which remain completely meristematic; these become the permanent intercalary growing zone. These structures belong to the adult plant.

The juvenile structures—rhizoidal lobe, pillar, and growth lobe—decay in part, the process being interpreted as resorption.

The relations of symmetry and dorsiventrality are briefly discussed.

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SOME HEPATICAE OF ALASKA

LOIS CLARK AND T. C. FRYE

By far the most of the gatherings of Hepaticae in Alaska have been within five miles of salt water. This is readily understood when one considers that roads are few, as are automobiles in which to travel them. The expense of travel is great and long distance travel is largely by airplane unless along salt water and very large rivers. Mosquitoes are a summer pest making that season less pleasant for an outing. The winters at least in the interior are severe and the ground covered with snow. Travel by dog-teams in winter is one of the better means. The expense of reaching Alaska is considerable. The cost of living when one gets there is greater than in the United States; and very few bryologists are paid their traveling expenses and subsistence for gathering bryophytes. Naturally, collecting is done along salt water where coastal freighters stop, where Coast Guard boats have business, and where supply boats for government schools land.

Almost all of the collecting has been done by those who do not know a moss from a liverwort, and who were not primarily interested in bryophytes. Naturally the larger ones would be gathered; the smaller ones would appear to be too insignificant or would not be noticed. To gather inconspicuous plants requires an eye trained to see the species in the particular group to be collected. One learns to hunt habitats and then look for the plants which may be expected there, looking sometimes with a hand lens. When we speak of a collector having a good eye for bryophytes we mean he has a good memory for habitats coupled of course with at least fair eyesight.

Alaska is large, as shown by the accompanying map. It presents exceedingly diverse conditions. In elevation it ranges from sea level to the top of Mt. McKinley, in latitude from 54° 40′, the "fifty-four forty or fight" of the war of 1812, to 71° 20′ at Pt. Barrow; or (observe the map) equivalent to the range in latitude from the southern point of Florida to the Great Lakes. The actual difference in climate is however greater, due to the Japan Current, which gives the southern coastal region of Alaska a winter with extreme cold no greater than that of Nogales, Arizona. Further, the warmer winter regions are extremely damp. Almost any liverwort growing north of the southern third of the United States and north of the Mediterranean Sea in Europe should find the winters of some parts of Alaska not too severe.

Follow on the accompanying map of the United States the border of Alaska and observe the territory of the United States which lies within. It becomes at once apparent that any complete list of the liverworts of Alaska is tentative and chiefly of use in the making of a new complete list a few years later. The need is for reports of occurrence, with locality, but from the interior rather than the periphery. Ours is merely a list of material gathered and not reported, nearly all of which was sent to us for determination, and unfortunately collected mostly from near salt water, and therefore the periphery.

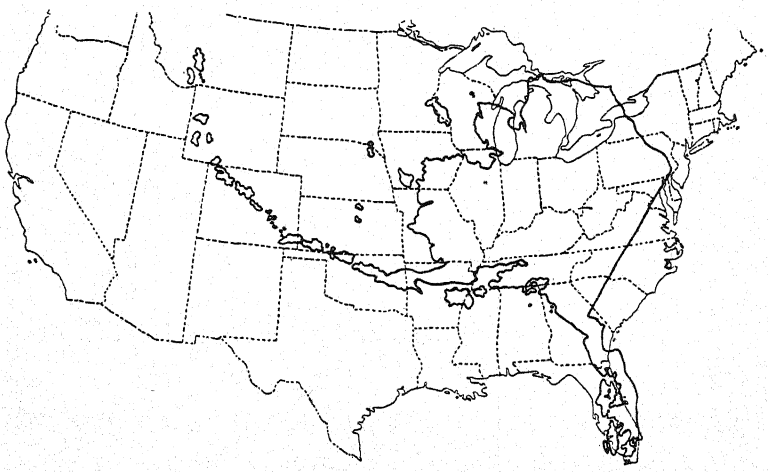

FIG. 1. Map of Alaska superimposed upon that of the United States to show comparative areas.

LOCALITIES WHERE HEPATICAE WERE COLLECTED

AKUTAN ISLAND. About Lat. 54° 8′ N., Long. 156° W. One of the eastern islands of the Aleutian chain.

ATKA ISLAND. About Lat. 52° 14′ N., Long. 174° 25′ W. A large island about the middle of the Aleutian chain.

BAKER ISLAND. About Lat. 55° 23′ N., Long. 133° 41′ W.

CAMP ISLAND. We have been unable to locate this.

CAPE DOUGLAS. About Lat. 58° 53′ N., Long. 153° 9′ W.

CAPE NOME. About Lat. 64° 36′ N., Long. 165° 16′ W. A rounded projection about 18 miles east of the city of Nome.

COPPER CENTER. About Lat. 61° 58′ N., Long. 145° 16′ W. On the Copper River and on the Valdez-Fairbanks highway.

CORDOVA. About Lat. 60° 30′ N., Long. 145° 45′ W. Near the southeast entrance to Prince William Sound.

DALL ISLAND. About Lat. 55° N., Long. 133° W. A large exposed island. We have been unable to locate Eolus Point on it.

DOUGLAS. A town across the channel from Juneau. About Lat. 58° 15′ N., Long. 134° 24′ W.

DRIER BAY. One of the indentations of Knight Island.

FARRAGUT BAY. About Lat. 57° 10′ N., Long. 133° 12′ W.

GLACIER BAY. A large body of water with mouth about Lat. 58° 25′ N., Long. 136° W.

GRAVINA ISLAND. About Lat. 55° 17′ N., Long. 131° 46′ W. A large island just across the channel west of Ketchikan.

HERBERT RIVER. About Lat. 58° 37′ N., Long. 134° 43′ W.

HINCHINBROOK ISLAND. About Lat. 60° 25′ N., Long. 146° 23′ W. A large island at the mouth of Prince William Sound.

JUNEAU. About Lat. 58° 18′ N., Long. 130° 22′ W. Capital and largest city in Alaska.

KETCHIKAN. About Lat. 55° 20′ N., Long. 131° 40′ W. One of the chief cities of Alaska.

KIANA. About Lat. 66° 59′ N., Long. 160° 27′ W. On the Kobuk River, which flows into Kotzebue Sound.

KING ISLAND. A small island directly south of Cape Prince of Wales. About Lat. 62° 59′ N., Long. 168° W.

KNIGHT ISLAND. About Lat. 60° 18′ N., Long. 147° 45′ W. A large island in the western part of Prince William Sound.

KODIAK. A town on Kodiak Island, about Lat. 57° 50′ N., Long. 152° 30′ W.

KOTSINA VALLEY. About Lat. 61° 36′ N., Long. 144° 16′ W. It seems to be the valley of a stream flowing southwestward into the Copper River or the Chitina River, close to where the latter flows into the former.

KOTZEBUE. About Lat. 66° 54′ N., Long. 162° 24′ W. Within Kotzebue Sound.

MIST HARBOR. One of the indentations on the east side of Nagai Island. The Island is about Lat. 55° 7′ N., Long. 160° W.

OLGA BAY. About Lat. 57° 7′ N., Long. 154° 3′ W. A long narrow indentation opening into the northern side of Alitak Bay, which opens into the ocean at the southwest corner of Kodiak Island.

ORCA. About Lat. 60° 34′ N., Long. 145° 40′ W. A small town opposite the east end of Hawkins Island and on the east shore of Prince William Sound.

PILLAR BAY. About Lat. 56° 40′ N., Long. 134° 14′ W. A double indentation along the west shore of Kuiu Island.

POPOF ISLAND. About Lat. 56° 26′ N., Long. 160° 22′ W.

PORTLAND CANAL. A fiord about 120 miles long and constituting the southeastern boundary of Alaska. Its mouth is about lat. 54° 26′ N., long. 130° 41′ W.

SQUAW HARBOR. About Lat. 55° 26′ N., Long. 160° 30′ W. Between Unga and Popof Islands.

ST. GEORGE ISLAND. One of the Pribilof group. About Lat. 56° 30′ N., Long. 169° 35′ W.

ST. PAUL ISLAND. One of the Pribilof group. About Lat. 57° 19′ N., Long. 170° 12′ W.

TENAKEE. About Lat. 57° 49′ N., Long. 145° 20′ W. On Tenakee Inlet, which opens on about the middle of the east shore of Chichagof Island.

THUMB BAY. An indentation of the southwest shore of Knight Island in Prince William Sound. About Lat. 60° 15′ N., Long. 147° 56′ W.

UNALASKA ISLAND. About Lat. 53° 52′ N., Long. 166° 45′ W. A large island of the Aleutian chain on which Dutch Harbor is situated.

VALDEZ. About Lat. 61° 8′ N., Long. 146° 18′ W. South end of the highway to Fairbanks.

WARD LAKE. About Lat. 55° 21′ N., Long. 131° 39′ W. Near Ketchikan.

WRANGELL. About Lat. 56° 28′ N., Long. 132° 23′ W. One of the larger cities of Alaska.

LIST OF SPECIES

ANTHELIA JULACEA (L.) Dum. Atka Island (*Eyerdam 117*) 1931; Mist Harbor (*Martel 283, 284*) 1935; Thumb Bay (*Eyerdam 17, 24, 39*) 1940. Greenland to Alaska south to Oregon and Montana.*

BARBILOPHOZIA BARBATA (Schmid.) Loeske. Olga Bay (*Looff*) 1940. Greenland to Alaska, south to Washington, New Mexico, Wisconsin and Connecticut.

BAZZANIA DENUDATA (Torr.) Trev. Ketchikan (*Eyerdam 4, 10*) 1940. Greenland to Alaska, south to Washington, Ohio and South Carolina.

BAZZANIA TRICRENATA (Wahl.) Trev. Juneau (*Mehner*) 1904; Wrangell (*Engstrom*) 1905; Pillar Bay (*Rigg*) 1929; Copper Center (*Thompson*) 1933; Ward Lake (*Anderson 5347*) 1939; Thumb Bay (*Eyerdam 35, 37, 41, 43, 46*) 1940. Newfoundland to New York and North Carolina; Alaska to Idaho and California.

BLEPHAROSTOMA TRICHOPHYLLUM (L.) Dum. Farragut Bay (*Kincaid*) 1899; Tenakee (*Williams*) 1933; Cordova (*Thompson*) 1933; Thumb Bay (*Eyerdam 49*) 1940. Greenland to Alaska, south to Mexico and North Carolina.

CALYPOGEIA NEESIANA (Massal. & Carest.) K. Muell. Olga Bay (*Looff*) 1938. Nova Scotia to Alaska, south to Washington, Wyoming, Tennessee and North Carolina.

CALYPOGEIA TRICHOMANIS (L.) Corda. Orca (*Eyerdam 111*) 1932; Ketchikan (*Eyerdam 9*) 1940; Thumb Bay (*Eyerdam 36, 49*) 1940. Labrador to Alaska, south to California, Oklahoma and Florida.

CEPHALOZIA BICUSPIDATA (L.) Dum. Copper Center (*Thompson*) 1932; Ketchikan (*Eyerdam 4, 9*) 1939; Thumb Bay (*Eyerdam 30a, 49*) 1940. Greenland to Alaska, south to Mexico and Florida.

CEPHALOZIA CONNIVENS (Dicks.) Lindb. Herbert River (*Anderson 5317*) 1939; Thumb Bay (*Eyerdam 35*) 1940. It was known from

* Only the North American distribution is given in all the following.

Nova Scotia to Minnesota and British Columbia, south to Iowa and Florida. New to Alaska. An extension of its range at least 1000 miles northwestward.

CEPHALOZIA MEDIA Lindb. Cordova (*Thompson*) 1933; Ketchikan (*Eyerdam 4, 4a, 4b, 9*) 1940. Greenland to Alaska, south to California, Wyoming and Florida.

CEPHALOZIA PLENICEPS (Aust.) Lindb. Thumb Bay (*Eyerdam 26*) 1940. Greenland to Alaska, south to California, New Mexico and New York.

CEPHALOZIELLA BYSSACEA (Roth) Warnst. Mendenhall, near Juneau (*Anderson 1517*) 1932; Olga Bay (*Looff*) 1938; Hinchinbrook Island (*Eyerdam 103*) 1931; Thumb Bay (*Eyerdam 13*) 1940. Greenland to Alaska, south to California, Wyoming, Minnesota and North Carolina. Only 2 of the 26 American species of *Cephaloziella* are known from Alaska.

CHILOSCYPHUS FRAGILIS (Roth) Schiffn. Olga Bay (*Looff*) 1938. This was known from Newfoundland to Michigan and British Columbia, south to California, Colorado and North Carolina. New to Alaska. At least 1000 miles from the nearest previously known locality.

CHILOSCYPHUS POLYANTHUS (L.) Corda. Popof Island (*Kincaid*) 1899; Olga Bay (*Looff*) 1938. Labrador to Alaska, south to California, Missouri and North Carolina.

CHILOSCYPHUS POLYANTHUS var. RIVULARIS (Schrad.) Loeske. Copper Center (*Thompson*) 1933. Newfoundland to Wisconsin and Alaska, south to California, New Mexico and North Carolina.

CONOCEPHALUM CONICUM (L.) Wigg. Kodiak (*Mylroie*) 1910; Eolus Point on Dall Island (*Mrs. E. P. Walker 750*) 1915; Ketchikan (*G. Willett*) 1925; Juneau (*Anderson 1511*) 1932, (*5286*) 1939; Cordova (*Thompson*) 1933; Akutan Island (*John Rudd*) 1935; Thumb Bay (*Eyerdam 41*) 1940. Common, throughout North America north of Mexico.

DIPLOPHYLLUM ALBICANS (L.) Dum. Farragut Bay (*Kincaid*) 1899; Wrangell (*Foster 2471*) 1913; Ketchikan (*Eyerdam 7a*) 1931; Orca (*Eyerdam 105*) 1932; Mist Harbor (*Martel 324*) 1935; Olga Bay (*Looff*) 1938; Thumb Bay (*Eyerdam 7a, 18b, 23, 30b, 39, 43a, 49, 105*) 1940. On the Atlantic Coast from Greenland to Maine; on the Pacific Coast from Alaska to Oregon.

DIPLOPHYLLUM HYALINUM Brinkman, THE BRYOLOGIST **43**: 40, 1940. Olga Bay (*Looff*) 1938. Brinkman segregated this from *D. plicatum* in material collected by Macoun on Mt. Arrowsmith, Vancouver Island, British Columbia. This Mt. Arrowsmith material was the only report of its occurrence. The Olga Bay material falls to this rather than to typical *D. plicatum*. The latter is known from Washington to Alaska and northern Asia.

DIPLOPHYLLUM TAXIFOLIUM (Wahl.) Dum. Olga Bay (*Looff*) 1938; Juneau (*Anderson 5295, 5300*) 1939. Labrador to Alaska, south to Oregon, Indiana and Virginia.

FRULLANIA NISQUALLENSIS Sull. Unalaska Island (*Eyerdam 117, 118*) 1932; Copper Center (*Thompson*) 1933; Gravina Island near Ketchikan (*Anderson 5291*) 1939; Thumb Bay (*Eyerdam 51*) 1940. Alaska, British Columbia, Alberta, Washington, Oregon, California. Only 4 of the 25 American species of Frullania are known from Alaska.

GYMNOCOLEA INFLATA (Huds.) Dum. Thumb Bay (*Eyerdam 52*) 1940. Greenland to Alaska, south to California, Wyoming, Minnesota and North Carolina.

GYMNOMITRIUM CORALLIOIDES Nees. St. Paul Island (*Kincaid* 235) 1897; Mist Harbor (*Martel 282*) 1935; Cannery Mt., Olga Bay (*Looff*) 1940. Greenland to Alaska, south to New York and New Hampshire.

GYMNOMITRIUM OBTUSUM (Lindb.) Pears. Olga Bay (*Looff*) 1938; Thumb Bay (*Eyerdam 18b, 30b*) 1940. Greenland to Alaska, south to Oregon and Montana.

GYROTHYRA UNDERWOODIANA Howe. Orca (*Eyerdam 111*) 1932. Alaska to California.

HARPANTHUS FLOTOWIANUS Nees. St. Paul Island (*Kincaid*) 1897. Greenland to Alaska, south to Washington, Montana and New Hampshire.

ISOPACHES HELLERIANUS (Nees) Buch. Thumb Bay (*Eyerdam 18b*) 1940. Nova Scotia to British Columbia, south to Washington, Minnesota and West Virginia. New to Alaska.

JUNGERMANNIA CORDIFOLIA Hook. Atka Island (*Eyerdam 120*) 1932. Greenland to Alaska, south to California, Colorado and Connecticut.

JUNGERMANNIA TRISTIS Nees. Atka Island (*Eyerdam 101*) 1932. It was known from Alberta to British Columbia, south to Montana and California; also Europe but not Asia. New to Alaska. This extends the known range of the species about 2000 miles westward.

LEIOCOLEA BANTRIENSIS (Hook.) Joerg. Thumb Bay (*Eyerdam 27*) 1940. This was known from Greenland; also Alberta to British Columbia, south to California. New to Alaska, although expected.

LEPIDOZIA REPTANS (L.) Dum. Farragut Bay (*Kincaid*) 1899; Juneau (*Mehner*) 1905; Pillar Bay (*Rigg*) 1929; Thumb Bay (*Eyerdam 35, 38*) 1940. Newfoundland to Minnesota and Alaska, south to California, New Mexico and North Carolina.

LEPIDOZIA SETACEA (Web.) Mitt. Farragut Bay (*Kincaid*) 1899; Olga Bay (*Looff*) 1938. Baffin Bay to Alaska, south to Michigan and South Carolina; also Mexico.

LOPHOZIA ALPESTRIS (Schleich.) Evans. Pillar Bay (*Rigg*) 1929; Thumb Bay (*Eyerdam 17, 18a, 30b, 31*) 1940. Greenland to Alaska, south to California, Colorado, Wisconsin and Connecticut.

LOPHOZIA INCISA (Schrad.) Dum. Douglas (*L. Clark 25, 27, 28*) 1909; Thumb Bay (*Eyerdam 49*) 1940. Greenland to Alaska, south to Mexico and North Carolina.

LOPHOZIA PORPHYROLEUCA (Nees) Schiffn. Douglas (*L. Clark 24*) 1909; Cordova (*Thompson*) 1933; Thumb Bay (*Eyerdam 11, 12, 13, 14a, 48*) 1940. Greenland to Alaska, south to California, Colorado, Wisconsin and Connecticut.

LOPHOZIA VENTRICOSA (Dicks.) Dum. Wrangell (*Engstrom*) 1905; Copper Center (*Thompson*) 1933; Camp Island (*O. Clark*) 1935. Olga Bay (*Looff*) 1940. Greenland to Alaska, south to California, Colorado, Iowa and North Carolina.

MADOTHECA CORDEANA (Hueben.) Dum. Mist Harbor (*Martel 290*) 1935; Olga Bay (*Looff*) 1940. Alaska, southward to California and New Mexico. Reports of it in the eastern half of the United States need to be checked.

MADOTHECA NAVICULARIS (L. & L.) Dum. Juneau (*Mehner 33*) 1904. Alaska to Mexico and eastward to Wyoming.

MADOTHECA ROELLII Steph. Mendenhall River near Juneau (*Anderson 5318*) 1939. Alaska to Montana, south to Idaho and California.

MANNIA SIBIRICA (K. Muell.) Frye & Clark. Kiana (*O. Clark*) 1937. While Joergensen (Bergens Museums Skrifter **16**: 30. 1934) states that it is found in northern North America, we know of no previous definite point of collection. Since it is known from Europe and Siberia one would expect it to occur in North America. Probably new to Alaska.

MARCHANTIA POLYMORPHA L. St. George Island (*Kincaid 93*) 1897; Glacier Bay (*Kincaid 28*) 1899; Juneau (*Anderson 1521*) 1932, (*5311*) 1939; Copper Center (*Thompson*) 1933; King Island (*Anderson 3217*) 1938; Olga Bay (*Looff*) 1938; Ward Lake (*Anderson 5349*) 1939; Valdez (*Eyerdam 42, 45*) 1940. Common throughout North America.

MARSUPELLA EMARGINATA (Ehrh.) Dum. Drier Bay (*Birkett 72*) 1907; Thumb Bay (*Eyerdam 25, 115*) 1940. Labrador to Alaska, south to California, Colorado and North Carolina.

MARSUPELLA EMARGINATA var. AQUATICA (Lindenb.) Dum. Thumb Bay (*Eyerdam 15, 21, 28*) 1940. Labrador to New Hampshire and New York. Not before known from the western part of North America.

METZGERIA CONJUGATA Lindb. Juneau (*Mehner 62*) 1904. Maine to Alaska, south to California, New Mexico, Louisiana and Florida.

METZGERIA PUBESCENS Raddi. Juneau (*Mehner 75*) 1904. Maine to the District of Columbia; Alaska to Montana and Oregon.

MOERCKIA FLOTOVIANA (Nees) Schiffn. Mendenhall near Juneau (*Anderson*) without date. Newfoundland to Michigan and Alaska, south to Washington, Nebraska and Connecticut.

MYLIA ANOMALA (Hook.) S. F. Gray. Kotsina Valley (*Dicky*) about 1930. Quebec to Alaska, south to Washington and West Virginia.

MYLIA TAYLORI (Hook.) S. F. Gray. Juneau (*Mehner*) 1904; Cordova (*Thompson*) 1933; Ward Lake (*Anderson 5349*) 1939; Orca

(*Eyerdam 1*) 1940; Thumb Bay (*Eyerdam 14a, 26, 38, 48*) 1940. Greenland to Alaska, and south to Washington, Illinois and New Hampshire.

NARDIA SCALARIS (Schrad.) S. F. Gray. Juneau (*Anderson 5295, 5296*) 1939; Olga Bay (*Looff*) 1940; Thumb Bay (*Eyerdam 13, 17, 18, 22, 29, 39*) 1940. Greenland to Alaska, south to Oregon and Wyoming.

ORTHOCAULIS GRACILIS (Schleich.) Buch. St. Paul Island (*Kincaid*) 1897. Greenland to Alaska, south to Washington, Colorado, Wisconsin and North Carolina.

PELLIA ENDIVIAEFOLIA (Dicks.) Dum. Juneau (*Anderson 5292, 5294*) 1939; Ketchikan (*Eyerdam 44*) 1940. Labrador to Alaska, south to California, Wyoming, Wisconsin and North Carolina.

PLAGIOCHILA ASPLENIOIDES (L.) Dum. Juneau (*Mehner 45*) 1904; Wrangell (*Engstrom 39*) 1905; Baker Island (*Foster*) 1913. Greenland to Alaska, south to Mexico and Florida.

PLAGIOCHILA FRYEI Evans. Ward Lake (*Anderson 5347*) 1939. Known only from the type collection at Augustine Bay on Dall Island, Alaska. This adds a locality about 70 miles northwestward.

PLECTOCOLEA OBOVATA (Nees) Mitt. Knight Island (*Eyerdam 34*) 1939; Thumb Bay (*Eyerdam 32, 43a*) 1940. Greenland to Alaska, south to California, Montana, Indiana and Maryland.

PLECTOCOLEA RUBRA (Gottsche) Buch. Juneau (*Mehner 43*) 1904, and (*Anderson 5293*) 1939. Alberta and British Columbia, south to California, Idaho and Montana. New to Alaska, although expected.

PLEUROCLADA ALBESCENS (Hook.) Spruce. Thumb Bay (*Eyerdam 17a, 30, 49*) 1940. Greenland to Alaska, south to California, Montana and Illinois.

PREISSIA QUADRATA (Scop.) Nees. Atka Island (*Eyerdam 116*) 1932, and (*West*) 1933; Kiana (*O. Clark*) 1937. Greenland to Alaska, south to Oregon, Colorado, Nebraska and Kentucky.

PTILIDIUM CALIFORNICUM (Aust.) Underw. Juneau (*Mehner*) 1905; Douglas (*L. Clark*) 1909; Kodiak (*Mylroie*) 1910; Camp Island (*O. Clark*) 1935; Kiana (*O. Clark*) 1937; Olga Bay (*Looff*) 1938. Alaska to Montana, south to Idaho and California.

PTILIDIUM CILIARE (L.) Hampe. Thumb Bay (*Eyerdam 33*) 1939. Greenland to Alaska, south to British Columbia, Montana, Iowa and Virginia.

PTILIDIUM PULCHERRIMUM (Web.) Hampe. Juneau (*Mehner 11, 80*) 1904; Kiana (*O. Clark*) 1937; Kotzebue (*O. Clark*) 1937. Newfoundland to Alaska, south to Washington, Montana, Iowa and North Carolina.

RADULA COMPLANATA Dum. Juneau (*Mehner 48, 56*) 1905. Nova Scotia to Manitoba and Alaska, south to Mexico and Florida.

RICCARDIA LATIFRONS Lindb. Thumb Bay (*Eyerdam 30a*) 1940. Newfoundland to Alaska, south to California, Wyoming, Illinois and Florida.

RICCARDIA PALMATA (Hedw.) Dum. Copper Center (*Thompson*) 1933. Nova Scotia to Alaska, south to Mexico and Florida.

RICCARDIA SINUATA (Dicks.) Trev. Farragut Bay (*Kincaid*) 1899. Nova Scotia to North Carolina; and Alaska to Alberta and California.

SACCOBASIS POLITA (Nees) Buch. Thumb Bay (*Eyerdam 49*) 1940. Greenland to Alaska, south to British Columbia, Alberta, Quebec and New Jersey.

SAUTERIA ALPINA (Nees & Bisch.) Nees. St. Paul Island (*Kincaid*) 1897. Greenland, Quebec, Alaska, British Columbia, Alberta.

SCAPANIA AMERICANA K. Muell. Thumb Bay (*Eyerdam 37*) 1940. Alaska to California.

SCAPANIA BOLANDERI Aust. Juneau (*Mehner 25, 49*) 1904; Douglas (*L. Clark*) 1910; Wrangell (*A. Geyer*) 1925; Ketchikan (*G. Willett*) 1926; Pillar Bay (*Rigg*) 1929; Orca (*Eyerdam 105*) 1932; Copper Center (*Thompson*) 1933; Cordova (*Thompson*) 1933; Juneau (*Anderson 5316*) 1939; Ketchikan (*Eyerdam 4*) 1940; Thumb Bay (*Eyerdam 46*) 1939, (*7a, 11, 12, 13, 14, 30a, 41, 43, 48*) 1940. Alaska to California.

SCAPANIA CURTA (Mart.) Dum. Cape Douglas (*Rigg 2*) 1913. Greenland to Alaska, south to California, Colorado and Maryland.

SCAPANIA IRRIGUA (Nees) Dum. Olga Bay (*Looff*) 1938. Greenland to Alaska, south to California, Wyoming, Wisconsin and the District of Columbia.

SCAPANIA PALUDOSA K. Muell. Atka Island (*Eyerdam 102, 119*) 1932; Squaw Harbor (*Jones 8887*) 1935; Olga Bay (*Looff*) 1938; Thumb Bay (*Eyerdam 3*) 1939, (*47*) 1940. Maine to Alaska, south to Oregon, Montana, Michigan and Massachusetts.

SCAPANIA ULIGINOSA (Sw.) Dum. Popof Island (*Kincaid*) 1899; Akutan Island (*John Rudd*) 1935. Greenland to Alaska, south to Washington, Colorado and New York.

SCAPANIA UMBROSA (Schrad.) Dum. Copper Center (*Thompson*) 1933; Juneau (*Anderson 5296, 5303*) 1939; Ward Lake near Ketchikan (*Anderson 5347*) 1939. Greenland to Alaska, south to California, Montana, Minnesota and New Hampshire.

SCAPANIA UNDULATA (L.) Dum. Olga Bay (*Looff*) 1938; Thumb Bay (*Eyerdam 19, 20*) 1940. Greenland to Alaska, south to Mexico and North Carolina.

SCAPANIA UNDULATA var. OAKESII (Aust.) Buch. Hinchinbrook Island (*Eyerdam 1 or 214*) 1934; Olga Bay (*Looff*) 1938; Knight Island (*Eyerdam 34*) 1939; Orca (*Eyerdam*) 1940; Thumb Bay (*Eyerdam 16, 29a*) 1940. This was known from Nova Scotia to British Columbia, south to California and Utah. New to Alaska.

SPHENOLOBUS MINUTUS (Crantz) Steph. Olga Bay (*Looff*) 1938. Greenland to Alaska, south to Washington, Alberta, Wisconsin and New Hampshire; also Mexico.

TEMNOMA SETIFORME (Ehrh.) Howe. Cape Nome (*Jones 9557*) 1936. Greenland to Alaska, south to British Columbia, Quebec and New Hampshire.

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FRANCISCO MARIANO PAGÁN, 1896–1942*

Doctor Francisco M. Pagán, Professor of Biology and Head of the Department of Biology of the University of Puerto Rico, died April 15, 1942, at Durham, North Carolina, where he was spending the year as Exchange Professor of Botany at Duke University.

Doctor Pagán was born August 19, 1896, on his father's coffee plantation in Barrio Rucio, above the small town of Peñuelas, in southwestern Puerto Rico. His boyhood was spent there, on the south flank of the high Cordillera Central. At the end of his second year of high school, in Ponce, he enlisted in the U. S. Army, and served as Corporal in Company K, Puerto Rico Infantry, in the Canal Zone. After two years of army life, he was honorably discharged on Dec. 4, 1918, at Camp Las Casas, Puerto Rico, by reason of the general demobilization order.

He finished his high school course in 1922. Then again his adventurous spirit asserted itself and he left the Island for higher education in the continental United States. In Chicago he passed civil service examinations for post office work with very high grades and was immediately given a position of night dispatcher, which he held throughout his college career. He had originally intended to prepare himself for medicine or dentistry, but since he was entirely self-supporting, it was impossible for him to enter a Class A medical or dental college. As the grade of work in the Class C medical colleges, one of which he actually attended for a short time, was incompatible with his high standards, he finally enrolled in the University of Chicago. Within a short time, after courses with Professor W. J. G. Land and Professor C. J. Chamberlain, he realized that he had found his life's work in

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botany. He received the B.S. degree in 1927, the M.S. in 1928, and the Ph.D. in 1931, all at Chicago. He was Doctor Land's last doctoral student and one of his favorites. Upon receiving his master's degree, Pagán married a fellow graduate student, Miss Stella Millan, who had just received the M.A. in mathematics.

During his last year of graduate work at Chicago, Doctor Pagán held the title of Fellow, and he was awarded an assistantship for the following summer (1931). In the autumn of 1928, he began his life-long association with the University of Puerto Rico, an institution which he had never attended. His uncommon ability, industry, and determination resulted in his very rapid rise through the academic grades in the Department of Biology. He held the title of Instructor from 1928–1930, of Assistant Professor from 1931–1934, of Associate Professor from 1935–1937, and received the full professorship in 1937. He became head of his department very early, in 1932, upon the elevation of his predecessor, Doctor Julio García-Díaz, to the position of Dean of the College of Arts and Sciences.

He was a member of the American Association for the Advancement of Science, the Botanical Society of America, the Sullivant Moss Society, the Michigan Academy of Science, Arts, and Letters, and of Sigma Xi.

Doctor Pagán's interest in the morphology of Hepaticae developed during the course of his work with Professor Land and resulted in his doctoral thesis on the development of *Riccia crystallina*. Later, his interests gradually enlarged to include systematic and floristic studies. Since the herbarium and library facilities of the University of Puerto Rico, primarily an undergraduate institution, were inadequate for taxonomic research, most of his summers were spent at various institutions in the States. He spent the summer of 1936 at the University of Michigan Biological Station, where his interest in the taxonomy of hepatics was encouraged by the late Professor George E. Nichols. At Doctor Nichols' recommendation, Doctor Pagán was appointed Visiting Fellow at Yale University for the academic year of 1937–1938. This year of study, during which he had the sympathetic help of Professor Alexander W. Evans, enabled him to finish his preliminary list of Puerto Rican Hepaticae (THE BRYOLOGIST, 1939). This research opportunity was soon followed by a year as Exchange Professor at the University of Michigan (1939–1940), where he continued his detailed study and revision of the Puerto Rican hepatics,

and started work on a catalogue of the Hepaticae of Guadeloupe. Much of the summer of 1940, before his return to Puerto Rico, was occupied by a trip to Mexico. At the time of his unexpected death, Doctor Pagán held the position of Exchange Professor at Duke University, *vice* Professor H. L. Blomquist.

Within a few weeks of his death, Doctor Pagán had completed two manuscripts, a catalogue of the Hepaticae of Guadeloupe and the description of a new species of *Dendroceros*. His important work on the Hepaticae of Puerto Rico, intended for publication in the "Scientific Survey of Porto Rico," was nearing completion, and he was laying the groundwork for a catalogue of the hepatics of Cuba. Through his many collecting seasons in Puerto Rico and elsewhere, he had collected the species of *Riccardia* especially assiduously, with the plan of eventually preparing a monographic treatment of this difficult genus.

Although Pagán and I considered ourselves good friends, and exchanged not only positions but homes for a year, our personal meetings were disappointingly few, and our contact was primarily through the medium of a voluminous correspondence. He never hesitated to disagree when he thought it necessary, but his opinions were all the more valued because they were so frank and sincere. During his stay in Ann Arbor and mine in Río Piedras, he took over the arduous and time-consuming task of managing the business of THE BRYOLOGIST: mailing, changing addresses, filling orders for back issues. This he did gladly as a labor of love, giving an example of his outstanding trait of working to see a job well done rather than for personal gain or recognition.

Doctor Pagán's death is a great loss to the thin ranks of professional bryologists, and is all the more to be regretted because of his tremendous energy and industry. It is hoped that his unfinished researches will be completed by other workers, although his death leaves only two or three persons working on tropical American Hepaticae. Doctor Pagán strove relentlessly and unflaggingly for higher standards in teaching and research at the University of Puerto Rico, and was in large part responsible for the establishment of a library in the Department of Biology and a research fund in the College of Arts and Sciences. He was never patient with slothfulness or incompetence, although his censure of those afflicted with these vices was often tempered by his delightful sense of humor. On the other hand, he rewarded industri-

ous and painstaking students and colleagues with unstinted help and praise. His high standards of research, teaching, and personal conduct will long be remembered by a host of students, colleagues, and other friends.—WILLIAM CAMPBELL STEERE

PUBLICATIONS OF F. M. PAGAN

PAGÁN, F. M. 1932. Morphology of the sporophyte of *Riccia crystallina*. Bot. Gaz. **93**: 71–84
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CATALOGUE OF THE HEPATICAE OF GUADELOUPE*

F. M. PAGÁN

Since 1839 the island of Guadeloupe has been systematically explored for hepatics. The first published account, however, did not appear until 1875 when T. Husnot[1] published a list comprising 57 species from material he had collected in Guadeloupe and Martinique in 1868. Of these 57 species 47 belonged to the flora of Guadeloupe. The next report, which appeared in 1893, was that of E. Bescherelle[2] in which 148 species were listed from the French Antilles (Martinique and Guadeloupe). Of the 148 species 133 were to be found in Guadeloupe. Bescherelle's account was based on material collected by Beaupertuis (1839), Perrottet (1842), Grateloup (1844), L'Herminier (1843–1862), Duchassaing (1847), Husnot (1868), Ed. Marie and Lefebvre (1877). The last published record of the Hepaticae of Guadeloupe was made by Père Duss[3] in 1903 in which he listed 218 species, based on material he had collected during the years 1887 to 1903. Of these 218 species 178 belonged to Guadeloupe.

In 1940 M. Adrien Questel of Pointe-à-Pitre, Guadeloupe, sent to the writer for study a collection of hepatics comprising 62 species.

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[1] Revue Bryologique **2**: 1–5. 1875.
[2] Jour. de Bot. **7**: 174–180; 183–194. 1893.
[3] Énum. Méth. Musc. Ant. Franç. I. Hépatiques, 8. Lons-le-Saunier. 1903

Some of these were found to be new to the Island. These, together with other species which have been reported from time to time since the publication of Duss' list, bring the total number of species known to the island to 269, a rather large number if we consider that the Island has an area of only 657 square miles.

The location of the specimens seen by the writer is indicated by the following abbreviations: Y, herbarium of Yale University; N. Y., herbarium of the New York Botanical Garden; P, private herbarium of the author at the University of Puerto Rico. For the most part, the information regarding other specimens was obtained from the following sources: T. Husnot, "Catalogue des Muscinées récoltées aux Antilles françaises," 1875; E. Bescherelle, "Énumération des Hépatiques connues jusqu'ici aux Antilles françaises (Guadeloupe et Martinique)," 1893; Père Duss, "Énumération Méthodique des Muscinées des Antilles françaises. I. Hépatiques," 1903.

In the preparation of this paper the writer is especially indebted to Professor A. W. Evans for his valuable suggestions and for the privilege of using his private library. Special thanks are due to Professors E. W. Sinnott and H. Castle of Yale University, to Dr. Margaret Fulford of the University of Cincinnati, and to Dr. Fred J. Seaver, Curator of Cryptogams in the New York Botanical Garden, and to Miss Rosalie Weikert, also of the New York Botanical Garden. He also wishes to express his gratitude to all those who in one way or another have made this work possible.

MARCHANTIACEAE

DUMORTIERA HIRSUTA (Sw.) Nees, Nova Acta Acad.-Carol. **12**: 410. 1824. *Marchantia hirsuta* Sw., Prodr. Fl. Ind. Occ. 145. 1788. Sur la terre, au bord de la rivière aux Excrévissés, *Husnot 199; L'Herminier 70* (Y); sur les pierres, les rochers, les racines, les bois pourris, Matelyane, Ravine-à-Déjeuner, Camp-Jacob (bois de la cascade de Vauchelet), rivières Noire, Rouge, etc., *Duss 366, 367, 392, 429, 714,* listed by Duss; Soufrière, *Questel 1607* (P).

DISTRIBUTION: Widely distributed in tropical regions; also found in western and southern Europe, and in the eastern United States.

MARCHANTIA CHENOPODA L., Sp. Pl. 1137. 1753. Bords des chemins, Savanes, *Husnot 196, 197, 198* (Y); Camp-Jacob, Monteran, Sofaïa, Ravine-Chaude, Gourbeyre, etc., *Duss 312a, 391* (N. Y.); Basse-Terre; Rivière aux Herbes, Galion, etc., *Duss 253* (N. Y.); Soufrière, *Questel 1531* (P); Petit Bourg, *Questel 1541* (P); St. Claude, *Questel 1579, 1581* (P).

DISTRIBUTION: South America and the West Indies.

MARCHANTIA PAPILLATA Raddi, Mem. Soc. Ital. Modena **19:** 44. 1823. *Marchantia papillata α brasiliensis* Raddi, Mem. Soc. Ital. Modena **19:** 44. 1823; **20:** *pl. 6a, f. 3, 4.* 1829. Sur les rochers humide, Vieux-Fort (chemin du morne Pavillon), *Duss 250, 251, 312, 392* (N. Y.); without definite locality or date, *L'Herminier 69* (listed by Bescherelle as *M. linearis*); sur la terre humide, les rochers, Matouba, Camp-Jacob, Trois-Rivières, Gourbeyre (Dole) etc., *Duss 320a, 321a* (listed by Duss as *M. domingensis* Lehm. et Lindenb.).

DISTRIBUTION: Southern United States, Mexico, Central and South America, Bahamas Islands, and the Antilles.

METZGERIACEAE

METZGERIA ALBINEA Spruce, Bull. Soc. Bot. Fr. **36** (Congr. Bot.): CCI. 1889. Sur les arbres, Savane-aux-Ananas, Saut-de-Bouillante, *Duss 323.*

DISTRIBUTION: Brazil, Bolivia, Martinique.

METZGERIA FURCATA (L.) Dum., Recueil d'Obs. sur les Jung. 26. 1835. *Jungermannia furcata* L., Sp. Pl. 1136. 1753. (in part). Commun sur les arbres des forêts, *Husnot 209* (Y); sur les arbrisseaux et dans les *Sphagnum*, sommet du morne Hirondelle, Savane-à-Mulets, Grande-Découverte, etc., *Duss 238, 399.*

DISTRIBUTION: Europe, Africa, Australia, New Zealand, eastern United States and the West Indies.

METZGERIA HAMATA Lindb., Acta Soc. F. et Fl. Fenn. **12:** 25. *f. 25.* 1877. Without definite locality, *l'Herminier 56 pp.* (Y); also without locality or number, *Ed. Marie*, listed by Bescherelle; sur les arbres, Matelyane, Grande-Découverte, Ravine-à-Déjeuner, *Duss 104* (Y), 397, listed by Duss.

DISTRIBUTION: Europe, Asia, North, South and Central America, West Indies, New Zealand.

METZGERIA PROCERA Mitt., in Hook. Fl. Nov. Zeal. **2:** 166. 1855. Sur les arbres et les racines, Savane-aux-Ananas, Savane-à-Mulets, bois elevés de Sofaïa, *Duss 41, 236, 248, 478, 479, 480;* Massig Central, in *Sphagnum, Questel 1606* (P); without definite locality or number, *Funck et Schlim; l'Herminier.*

DISTRIBUTION: Martinique, Dominica, Bolivia.

METZGERIA VIVIPARA Evans, Ann. Bot. **24:** 287. *f. 11.* 1910. Sur les arbres, *Duss 85* (Y).

DISTRIBUTION: Puerto Rico.

PALLAVICINIACEAE

PALLAVICINIA LYELLII (Hook.) S. F. Gray, Nat. Arr. Brit. Pl. **1:** 775. 1821. *Jungermannia Lyellii* Hook., Brit. Jung. *pl. 77.* 1816.

Sur le tronc des fougères en arbre, Vallée St. Louis, rivière Rouge, *Husnot 208;* bois des Bains-Jaunes, du Gommier, de la Vallée de St. Louis, *Duss 57* (Y), *363;* Soufrière, *Questel 1609* (P).

DISTRIBUTION: Widely distributed, especially in tropical regions.

SYMPHYOGYNA ASPERA Steph., McCormick, Bot. Gaz. **58:** 401. *pl. 30–32.* 1914. Sur les troncs pourris, Pitons du Carbet, Vallée St. Louis, La Découverte, *Husnot 210* (N. Y.), (as *S. sinuata*); *Beaupertuis; L'Herminier 71* (listed by Bescherelle as *S. sinuata*).

DISTRIBUTION: South America and the West Indies.

SYMPHYOGYNA BRASILIENSIS Nees; Nees et Mont. in Ann. Sci. Nat. Bot. II. **5:** 16. 1836. *Jungermannia brasiliensis* Nees, Enum. Pl. Crypt. Javae **1:** 11. 1830. Sur les pierres et les rochers humides, talus de la rivière St. Louis, *Duss 421.*

DISTRIBUTION: Mexico, Central and South America, and the West Indies.

SYMPHYOGYNA BRONGNIARTII Mont., Ann. Sci. Nat. Bot. II. **19:** 265. *pl. 9, f. 1.* 1843. Sur les rochers du Bassin-Bleu, *Duss 313* (N. Y.) (listed by Duss as *S. sinuata*); Pointe-Noire, *Duss 1056* (N. Y.), *1138* (Y).

DISTRIBUTION: Central and South America, the Antilles.

SYMPHYOGYNA DIGITISQUAMA Steph., Spec. Hep. **1:** 355. 1900. Sur les pierres de la rivière St. Louis, *Husnot 207* (listed by Husnot as *S. brasiliensis* Nees); *L'Herminier* (as *S. brasiliensis* Nees); Bois des Bains-Jaunes, Ravine-à-Déjeuner, *Duss 48 pp. 218, 299* (N. Y.) (listed by Duss as *S. limbata* Steph.); Matouba, Rivière Rouge, *Duss 123 pp.* (N. Y.).

DISTRIBUTION: Jamaica, Martinique, Venezuela.

SYMPHYOGYNA MARGINATA Steph., Spec. Hep. **1:** 334. 1900. Bois des Bains-Jaunes, Ravine-à-Déjeuner, *Duss 48 pp.* (N. Y.); Matouba, Rivière Rouge, *Duss 123 pp.* (N. Y.).

DISTRIBUTION: Dominica, Martinique.

SYMPHYOGYNA TRIVITTATA Spruce, Jour. Linn. Soc. Bot. **30:** 365. *pl. 30. f. 7–11.* 1895. Sur les parois des rochers, sur la terre et les pierres humides, Ravine-à-Déjeuner, *Duss 48 pp.* (N. Y.); Matouba, bords de la rivière Rouge, *Duss 123 pp.* (N. Y.).

DISTRIBUTION: Cuba, Puerto Rico, Martinique, Dominica.

MONOCLEACEAE

MONOCLEA GOTTSCHEI Lindb., Rev. Bryol. **13:** 102. 1886. Without definite locality or number, *L'Herminier* (Y); sur le sol, les pierres, les bois pourri dans les endroits des grands bois, Ravine-à-Déjeuner, au pied de la Grande-Découverte, versant du Matouba, Matelyane, etc., *Duss 422;* Massig Central, *Questel 1504* (P).

DISTRIBUTION: Central and South America, the Antilles.

RICCARDIACEAE

RICCARDIA DIGITILOBA (Spruce) Pagán, THE BRYOLOGIST **42**: 6. 1939. *Aneura digitiloba* Spruce, Bull. Soc. Bot. Fr. **36** (Congr. Bot.): CCI. 1889. Without number, Bains-Jaunes, *Lefebvre et Marie;* Petit Bourg, *Questel 1555* (*P*).

DISTRIBUTION: Brazil, Puerto Rico, Dominica.

RICCARDIA **diablotina** (Spruce) comb. nov. *Aneura diablotina* Spruce, Jour. Linn. Soc. Bot. **30**: 366. 1895. Rampant sur les écorces, Savane-aux-Ananas, *Duss 76 pp.* (Y., N. Y.).

DISTRIBUTION: Martinique, Dominica.

RICCARDIA **distans** (Spruce) comb. nov. *Aneura distans* Spruce, Jour. Linn. Soc. Bot. **30**: 367. 1895. Massig Central, in *Sphagnum, Questel 1523* (P).

DISTRIBUTION: Dominica.

RICCARDIA **Fendleri** (Steph.) comb. nov. *Aneura Fendleri* Steph., Hedwigia **32**: 20. 1893. Without definite locality or number, *Ed. Marie;* without number, Bains-Jaunes, *Lefebvre.*

DISTRIBUTION: Trinidad.

RICCARDIA FUCOIDES (Sw.) Schiffn., Conspect. Hepat. Arch. Indici 54. 1898. *Jungermannia fucoides* Sw., Prodr. Fl. Ind. Occ. 45. 1788. Sur les troncs pourris et les rochers humides, Vallée St. Louis, La Découverte, *Husnot 205;* without number or definite locality, *Beaupertuis;* without definite locality, *L'Herminier 71 pp.;* without number, du camp Jacob à la cascade Vauchelet, *Lefebvre;* without number, Camp Jacob, *Ed. Marie;* Bois des Bains-Jaunes et du Matouba, *Duss 143, 327, 473;* Massig Central, in *Sphagnum, Questel 1522* (P).

DISTRIBUTION: Central and South America, the Antilles.

RICCARDIA **grossidens** (Steph.) comb. nov. *Aneura grossidens* Steph. Hedwigia **32**: 23. 1893. Without definite locality or number, *L'Herminier.*

DISTRIBUTION: Dominica.

RICCARDIA **innovans** (Steph.) comb. nov. *Aneura innovans* Steph., Hedwigia **40**: 470. 1901. Sur les arbrisseaux, Savane-à-Mulets, *Duss 484.*

DISTRIBUTION: Known only from Guadeloupe.

RICCARDIA **planifrons** (Spruce) comb. nov. *Aneura planifrons* Spruce, Jour. Linn. Soc. Bot. **30**: 368. 1895. Sur les arbres, morne Graine-Verte, Matelyane, *Duss 71, 442, 490.*

DISTRIBUTION: St. Vincent, Dominica, Martinique.

RICCARDIA SINUATA (Dum.) Trevis., Mem. r. Ist. Lomb. III. **4**: 431. 1877. *Aneura sinuata* Dum., Comm. Bot. 115. 1822. Sur les bois pourris, morne de la Découverte, *Husnot 256* (as *A. pinnatifida* var. *contexta*) (Y); *Duss 76 pp.* (Y).

DISTRIBUTION: Europe, North America, Asia.

RICCARDIA **stipatiflora** (Steph.) comb. nov. *Aneura stipatiflora* Steph., Hedwigia **32**: 27. 1893. Sur le sol humide, les troncs de vieux arbres, quelquefois sur les feuilles, Matouba; Gourbeyre; Trois-Rivières, etc., *Duss 318, 319, 326, 398.*

DISTRIBUTION: Martinique, Dominica.

RICCARDIA **subsimplex** (Steph.) comb. nov. *Aneura subsimplex* Steph., Hedwigia **32**: 26. 1893. Sur l'écorce du bois pourrissant; Matouba, *Duss 182, 457* (Y).

DISTRIBUTION: Cuba.

RICCARDIA VIRGATA (Gott.) Pagán, THE BRYOLOGIST **42**: 7. 1939. *Aneura virgata* Gott., in Steph. Hedwigia **27**: 277. 1888. Without definite locality, *L'Herminier 71 pp.;* sur les arbres, les rochers; bois du Matouba, *Duss 358* (Y).

DISTRIBUTION: Jamaica, Puerto Rico. Martinique.

HAPLOMITRIACEAE

CALOBRYUM ANDINUM (Spruce) Steph., Spec. Hep. **1**: 400. 1900. *Scalia andina* Spruce, Trans. and Proc. Edinb. Bot. Soc. **15**: 532. 1885. Without definite locality or number, *L'Herminier* (as *Haplomitrium mnioides* Gott.); Sur les pierres et souvent associé à d'autres hépatiques ou à des mousses; Ravine-à-Déjeuner (au pied de la Grande-Découverte et versant de Matouba), *Duss 423* (as *Haplomitrium mnioides* Gott.); Gommier, rivière Noire, rivière Malanga, *Duss 156;* Soufrière, *Questel 1530* (P).

DISTRIBUTION: Peru, Dominica.

HARPANTHACEAE

APOTOMANTHUS SUCCULENTUS (Rich.) Schiffn., in Engler and Prantl, Natür. Pflanzenfam. 1^3: 91. 1893. *Jungermannia succulenta* Rich., in Lehm. et Lindenb. Pug. Pl. **4**: 43. 1832. Sur les rochers au bord des sources sulfureuses très chaudes; Bainschaude du Matouba, source du Galion, *Husnot 232* (Y); autour des sources sulfureuses, *Duss 82, 228, 275.*

DISTRIBUTION: Tropical America.

LOPHOCOLEA BREUTELII Gott., G. L. N. Syn. Hep. 154. 1845. Without definite locality or number, *L'Herminier;* sur les arbres, souvent associé à d'autres hépatiques, Savane-aux-Ananas, *Duss 265.*

DISTRIBUTION: Martinique, St. Kitts, Dominica.

LOPHOCOLEA COADUNATA (Sw.) Nees, G. L. N. Syn. Hep. 158. 1845. *Jungermannia coadunata* Sw., Fl. Ind. Occ. **3**: 1850. 1806. Sur les arbres, Bois du Mayelyane, du Nez-Cassé, de la rivière Rouge, *Duss 7, 18, 83, 698.*

DISTRIBUTION: Jamaica, Martinique.

LOPHOCOLEA CONNATA (Sw.) Nees, G. L. N. Syn. Hep. 153. 1845. *Jungermannia connata* Sw., Prodr. Fl. Ind. Occ. 143. 1788. Sur les

vieux arbres, La Découverte, *Husnot 240* (Y); without definite locality or number, *L'Herminier;* without number, Bains-Jaunes, *Lefebvre et Ed. Marie.*

DISTRIBUTION: Jamaica, Puerto Rico, Guiana.

LOPHOCOLEA GUADALUPENSIS Steph., Spec. Hep. **3**: 153. 1907. Without definite locality or number, *Perrottet, L'Herminier.*

DISTRIBUTION: Known only from Guadeloupe.

LOPHOCOLEA MARTIANA Nees, G. L. N. Syn. Hep. 152. 1845. Sur les écorces et les feuilles, Gourbeyre, *Duss 100* (Y), *153, 216, 442.*

DISTRIBUTION: Widely distributed in tropical America; also found in Florida.

LOPHOCOLEA MASCULA Gott., Ann. Sci. Nat. Bot. V. **1**: 128. 1864. Sur les bois pourrissant, morne Graine-Verte, *Duss 433, 461.*

DISTRIBUTION: Peru, Colombia.

LOPHOCOLEA TRAPEZOIDEA Mont., Ann. Sci. Nat. Bot. II. **19**: 251. 1843. Without definite locality or number, *Perrottet;* sur les arbres et les racines, Matouba, bord de la rivière Rouge, *Duss 396.*

DISTRIBUTION: Martinique, Dominica.

LOPHOCOLEA URBANII Steph., Spec. Hep. **3**: 143. 1906. Without definite locality or number, *Duss.*

DISTRIBUTION: Known only from Guadeloupe.

MYLIA ANTILLANA Carr. et Spruce, Bull. Soc. Bot. Fr. **36** (Congr. Bot.): CLXXVII. *pl. 4.* 1889. *Leioscyphus antillanus* Steph., Spec. Hep. **3**: 19. 1906. Without definite locality or number, *Perrottet.*

DISTRIBUTION: Known only from Guadeloupe.

MYLIA GIBBOSA (Tayl.) Pagán, THE BRYOLOGIST **42**: 9. 1939. *Chiloscyphus gibbosus* Tayl., Lond. Jour. Bot. **5**: 283. 1846. Sur les troncs pourris, Bains-Chaude de Matouba, *Husnot 225* (as *Leioscyphus Liebmannianus* var. *guadalupensis*); sur les arbres, Morne l'Echelle, *Duss. 553.*

DISTRIBUTION: West Indies.

MYLIA **hexagona** (Nees) comb. nov. *Chiloscyphus hexagonus* Nees, G. L. N. Syn. Hep. 177. 1845. Dans les sphagnums, sur les petioles des *Lomaria,* sur les tiges des arbrisseaux, morne l'Echelle, morne Goyave, cône de la Soufrière, Bains-Chauds, *Duss 60* (Y), *135.*

DISTRIBUTION: Peru.

MYLIA **ovata** (Spruce) comb. nov. *Leioscyphus ovatus* Spruce, Jour. Linn. Soc. Bot. **30**: 357. 1895. Sur les racines d'un arbre dans une ravine près du sommet du morne Hirondelle, *Duss 474, 476* (Y).

DISTRIBUTION: Dominica.

JUNGERMANNIACEAE

JUNGERMANNIA OBTUSIFLORA Steph., Spec. Hep. **2**: 69. 1901. Described by Stephani without definite locality or number, *L'Herminier.*

DISTRIBUTION: Known only from Guadeloupe.

LOPHOZIA SCHISTOPHILA (Spruce) Steph., Spec. Hep. **2**: 146. 1902. *Jungermannia schistophila* Spruce, Trans. and Proc. Edinb. Bot. Soc. **15**: 513. 1885. Without number, Sainte-Rose, *Ed. Marie*, listed by Bescherelle as *Jung.* (*Lophozia*) *schistophila* Spruce.
DISTRIBUTION: Peru, Brazil, Puerto Rico, Dominica.

ANASTROPHYLLUM CONFORME (Lindenb. et Gott.) Steph., Hedwigia **32**: 140. 1893. *Jungermannia conformis* Lindenb. et Gott., G. L. Syn. Hep. 665. 1847. Chemin des sources du Galion à la Grande-Citerne, Savane-à-Mulets, cône de la soufrière, *Duss 124.*
DISTRIBUTION: Mexico, Brazil, Venezuela, Panama.

PLAGIOCHILACEAE

PLAGIOCHILA ADIANTOIDES (Sw.) Dum., Recueil d'Obs. sur les Jung. 15. 1835. *Jungermannia adiantoides* Sw., Prodr. Fl. Ind. Occ. 142. 1788. Sur les arbres des forêts, *Husnot 214a* (Y); sur les arbres, les racines et les pierres, chemin de la Grande-Citerne *Duss 412, 2142.*
DISTRIBUTION: Tropical America.

PLAGIOCHILA AMOENA Steph., Spec. Hep. **2**: 505. 1905. Sur les arbres de la Découverte, *Husnot 224* (listed as *P. Breuteliana* var. *guadalupensis* Gott.).
DISTRIBUTION: Known only from Guadeloupe.

PLAGIOCHILA ANGUSTISPICA Steph., Spec. Hep. **2**: 206. 1902. Described by Stephani without definite locality or number, *L'Herminier.*
DISTRIBUTION: Known only from Guadeloupe.

PLAGIOCHILA BIDENS Gott., Ann. Sci. Nat. Bot. IV. **8**: 332. *pl. 10, f. 1–5.* 1857. Without definite locality or number, *Ed. Marie;* without definite locality, *L'Herminier 56 pp.*, listed by Bescherelle as *P. gymnocalycina* var. β.; sur les arbres, bois supérieurs des Bains-Jaunes, *Duss 87, 271.*
DISTRIBUTION: Puerto Rico, Martinique, Dominica.

PLAGIOCHILA BREUTELIANA Lindenb., Spec. Hep. 150. *pl. 32.* 1844. Without definite locality or number, *Husnot, L'Herminier, Beaupertuis.*
DISTRIBUTION: Mexico, Costa Rica, Colombia, Cuba, Puerto Rico, St. Kitts, St. Vincent, Dominica.

PLAGIOCHILA BURSATA (Desv.) Lindenb., Spec. Hep. 88. *pl. 15.* 1844. *Jungermannia bursata* Desv., Jour. de Bot. **4**: 59. *pl. 23. f. 1. a. b.* 1824. Savane-aux-Ananas, *Husnot 218;* without definite locality or number, *L'Herminier;* sur les arbres, Matouba, Savane-aux-Ananas, *Duss 407.*
DISTRIBUTION: Widely distributed in tropical America.

PLAGIOCHILA CONNATA Lindenb. et Gott., G. L. N. Syn. Hep. 645. 1847. Without definite locality or number, *L'Herminier*, reported by Stephani in Spec. Hep. **2**: 519. 1905.

DISTRIBUTION: Mexico.

PLAGIOCHILA CONTIGUA Gott., Mex. Leverm. 30. *pl. 14. f. 1–6.* 1863. Without definite locality, *L'Herminier, 70, 71 pp.*, listed by Bescherelle; sur le sol humide, Plateau de la Soufrière, bois du Nez-Cassé, *Duss 46, 166.*

Distribution: Mexico, Brazil, Puerto Rico, Martinique.

PLAGIOCHILA CRISTATA (Sw.) Dum., Recueil d'Obs. sur les Jung. 15. 1835. *Jungermannia cristata* Sw., Prodr. Fl. Ind. Occ. 143. 1788. Sur les arbres, Vieux-Fort, chemin du morne Pavillon, *Duss 198*, listed by Duss as *P. cristatissima* Steph.

DISTRIBUTION: Mexico, Costa Rica, Peru, Brazil, Jamaica, St. Vincent.

PLAGIOCHILA DESCISCENS Steph., Spec. Hep. **2**: 236. 1902. Described by Stephani as being collected by *L'Herminier*, without definite locality.

DISTRIBUTION: Known only from Guadeloupe.

PLAGIOCHILA DICHOTOMA (Web.) Dum., Recueil d'Obs. sur les Jung. 15. 1835. *Jungermannia dichotoma* Web., Hist. Musc. Hep. Prodr. 133. 1815. Massig Central, *Questel 1503* (P).

DISTRIBUTION: Brazil, Trinidad, Jamaica, Puerto Rico.

PLAGIOCHILA DIVARICATA Lindenb., Spec. Hep. 147. *pl. 32.* 1844. Sur les arbres, Bois des Bains-Jaunes, des hauteurs des Vieux-Habitants, de Bouillante et de Pigeon, du Matelyane, *Duss 85, 95, 315a.*

DISTRIBUTION: French Guiana, St. Vincent, Dominica, Martinique.

PLAGIOCHILA DIVERSISPINA Steph., Spec. Hep. **2**: 569. 1905. Reported by Stephani without definite locality or number, *L'Herminier.*

DISTRIBUTION: Venezuela.

PLAGIOCHILA DOMINICENSIS Tayl., Lond. Jour. Bot. **5**: 270. 1846. Without definite locality or number, *L'Herminier*, listed by Bescherelle as *P. Magdalena* Gott.

DISTRIBUTION: Mexico, Venezuela, Columbia, Cuba, Puerto Rico, Dominica.

PLAGIOCHILA DURIEUI Gott., in G. et R., Hep. Exsicc. No. 553. Without definite locality, *Durieu, L'Herminier 553* (Y); Massig Central, *Questel 1520* (P).

DISTRIBUTION: Martinique, Dominica, St. Kitts, Ecuador.

PLAGIOCHILA ERRONEA Steph., Spec. Hep. **2**: 242. 1902 Sur les arbres de la vallée St. Louis et de la Soufrière, *Husnot 217* (Y) (listed as *P. simplex* (Sw.) Lindenb. by Husnot); without definite locality, *L'Herminier 56, 71 pp.;* sur les arbres, vallée St. Louis, Trois-Rivières (bois de la Madeleine), *Duss 409.*

DISTRIBUTION: Brazil, Puerto Rico.

PLAGIOCHILA FLACCIDA Lindenb., Spec. Hep. 78. *pl. 16.* 1844.

Without definite locality or number, *L'Herminier*, listed by Bescherelle.

DISTRIBUTION: Brazil, Venezuela, Puerto Rico, St. Vincent.

PLAGIOCHILA GERMANI Steph., Spec. Hep. **2**: 588. 1905. Without definite locality or number, *L'Herminier, Germain.*

DISTRIBUTION: Known only from Guadeloupe.

PLAGIOCHILA GRATELOUPII Mont., Ann. Sci. Nat. Bot. IV. **6**: 188. 1856. Without definite locality or number, *Grateloup, Perrottet;* sur les arbres, bois du plateau des Palmistes, *Duss 311a, 317b;* Petit Bourg, *Questel 1546* (P).

DISTRIBUTION: Known only from Guadeloupe.

PLAGIOCHILA GUADALUPENSIS Gott., in Husnot, Rev. Bryol. **2**: 2. 1875. Sur les arbres dans les forêts de la Découverte, *Husnot 215* (Y); sur les arbres et les souches, Pigeon (habitation Maler), saut-de-Bouillante, Grande-Découverte, *Duss 114, 311a.*

DISTRIBUTION: Dominica.

PLAGIOCHILA HERMINIERI Steph., Spec. Hep. **2**: 547. 1905. Described by Stephani without definite locality or number, *L'Herminier.*

DISTRIBUTION: Known only from Guadeloupe.

PLAGIOCHILA HUSNOTI Steph., Spec. Hep. **2**: 506. 1905. Without definite locality or number, *L'Herminier;* au pied d'un arbrisseaux, morne Goyave, *Duss 469* (Y).

DISTRIBUTION: Dominica, Puerto Rico.

PLAGIOCHILA HYPNOIDES Lindenb., Spec. Hep. 37. *pl. 7 and 11.* 1844. Without definite locality, *L'Herminier 61, 66RR, 71,* listed by Bescherelle.

DISTRIBUTION: Common in tropical America.

PLAGIOCHILA MACROSTACHYA (Sw.) Lindenb., Spec. Hep. 75. *pl. 14.* 1844. *Jungermannia macrostachya* Sw., Prodr. Fl. Ind. Occ. 142. 1788. Without definite locality or number, *L'Herminier;* reported by Stephani in Spec. Hep. **2**: 574.

DISTRIBUTION: Jamaica, Trinidad, Venezuela.

PLAGIOCHILA PERROTTETIANA Mont. et Gott., Ann. Sci. Nat. Bot. IV. **6**: 195. 1856. Sur les arbres des forêts, La Découverte et la Soufrière, *Husnot 216;* sur les arbres, Gourbeyre (sommet du morne Hirondelle) *Duss 414.*

DISTRIBUTION: Martinique, Dominica.

PLAGIOCHILA PROCERA Lindenb., Spec. Hep. 40. *pl. 7.* 1844. Without definite locality or number, *L'Herminier;* also reported by Stephani in Spec. Hep. **2**: 533.

DISTRIBUTION: Costa Rica, Colombia, Bolivia, Cuba, Jamaica, Dominica.

PLAGIOCHILA RUTILANS Lindenb., Spec. Hep. 47. *pl. 9, 11 and 31.*

1844. Without definite locality, *L'Herminier 56 ep.* (listed by Bescherelle as *P. gymnocalycina*); *L'Herminier 59* (Y); without definite locality or number, *L'Herminier,* listed by Bescherelle as *P. portoricensis* Hpe. et Gott.; sur les arbres, Matouba, plateau supérieurs des Palmistes, *Duss 284, 322a,* listed by Duss as *P. portoricensis* Hpe. et Gott.; Bois des Bains-Jaunes, *Duss 110* (as *P. remotifolia*); au pied des arbres sur les grosses pierres, Gourbeyre (morne Hirondelle), *Duss 494* (as *P. remotifolia*); Petit Bourg, *Questel 1545* (P).

DISTRIBUTION: Central and South America, the Antilles.

PLAGIOCHILA SAXICOLA Steph., Spec. Hep. **2**: 552. 1905. Described by Stephani without definite locality or number, *L'Herminier;* sur les pierres et les rochers, morne Graine-Verte, *Duss 453.*

DISTRIBUTION: Known only from Guadeloupe.

PLAGIOCHILA STRICTA Lindenb., Spec. Hep. 20. *pl. 3.* 1844. Sur les arbres, chemin du Matelyane à la Savane-aux-Ananas, *Duss 73* (Y).

DISTRIBUTION: Jamaica, Trinidad, Brazil.

PLAGIOCHILA SUPERBA (Nees) Dum., Recueil d'Obs. sur les Jung. 15. 1835. *Jungermannia superba* Nees, Spreng. Syst. Veg. 4^2: 326. 1827. Massig Central, *Questel 1505* (P).

DISTRIBUTION: Guatemala, Costa Rica, Bolivia, Brazil, Trinidad, Puerto Rico, St. Vincent, Dominica, Martinique.

PLAGIOCHILA SYLVICULTRIX Spruce, Trans. and Proc. Edinb. Bot. Soc. **15**: 468. 1885. Without definite locality or number, *L'Herminier;* Massig Central, in *Sphagnum, Questel 1525* (P).

DISTRIBUTION: Guatemala, Costa Rica, Brazil, Trinidad, St. Kitts, St. Vincent, Puerto Rico.

PLAGIOCHILA TAMARISCINA Steph., Spec. Hep. **2**: 222. 1902. Without definite locality, *L'Herminier, 64 pp.* (Y) (listed by Bescherelle as *P. distinctifolia*); sur les arbres, morne Papaye, *Duss* 405 (as *P. distinctifolia*); Vieux-Fort, *Duss 195.*

DISTRIBUTION: St. Domingo, Puerto Rico, Martinique, Trinidad, Dominica.

PLAGIOCHILA TENUIS Lindenb., Spec. Hep. 50. *pl. 10.* 1844. Listed by Bescherelle, without definite locality, *L'Herminier 55 pp. 56;* without number, Le Gommier, *Ed. Marie;* without definite locality or number, *Duchassaing;* sur les arbres, bois intérieurs de la Pointe-Noire, *Duss 1057a* (Y).

DISTRIBUTION: Brazil, Venezuela, Trinidad, St. Kitts, St. Vincent, Dominica, Martinique, Puerto Rico.

PLAGIOCHILA VINCENTINA Lindenb., Spec. Hep. 39. *pl. 8.* 1844. Without definite locality or number, *L'Herminier;* sur les arbres, Capesterre (bois du Grand-Étang et de l'Étang-Zombi), Gourbeyre (morne Gobelin), *Duss 146;* Bains-Jaunes, *Questel 1594* (P).

DISTRIBUTION: Costa Rica, Colombia, Ecuador, Trinidad, St. Vincent, Martinique.

SYZYGIELLA CONTIGUA (Gott.) Steph., Spec. Hep. **2**: 189. 1902. *Jungermannia contigua* Gott., Ann. Sci. Nat. Bot. V. **1**: 24. 1864. Sur le sol humide, plateau de la Soufrière, bois du Nez-Cassé, *Duss 46, 166* (Y).

DISTRIBUTION: Colombia, Brazil, Martinique.

SYZYGIELLA INTEGERRIMA Steph., Spec. Hep. **6**: 117. 1917. Sur les arbres, sur les bois pourris, bois intérieurs de la Pointe-Noire, *Duss 1053* (Y).

DISTRIBUTION: Known only from Guadeloupe.

SYZYGIELLA LAEVIGATA (Spruce) Steph., Hedwigia, **34**: 239. 1895. *Syzygiella perfoliata* var. *laevigata* Spruce, Jour. Linn. Soc. Bot. **30**: 362. *pl. 28. f. 6–9.* 1895. Reported by Stephani, without definite locality or number, *Duss.*

DISTRIBUTION: Antilles.

SYZYGIELLA MACROCALYX (Mont.) Spruce, Jour. Bot. **14**: 32. 1876. *Jungermannia macrocalyx* Mont., Ann. Sci. Nat. Bot. II. **19**: 248. 1843. Without definite locality or number, *L'Herminier*, listed by Bescherelle; sur les branches des arbres et d'arbrisseaux, Morne Goyave, *Duss 415.*

DISTRIBUTION: Martinique.

SYZYGIELLA PERFOLIATA (Sw.) Spruce, Jour. Bot. **14**: 32. 1876. *Jungermannia perfoliata* Sw., Prodr. Fl. Ind. Occ. 143. 1788. Sur les herbes et les arbrisseaux, Savane-à-Mulets, *Duss 485* (Y).

DISTRIBUTION: Jamaica, Puerto Rico.

SYZYGIELLA SETULOSA Steph., Spec. Hep. **2**: 188. 1902. Described by Stephani without definite locality or number, *Duss.*

DISTRIBUTION: Known only from Guadeloupe.

TYLIMANTHUS AMPLEXIFOLIUS (Hampe) Steph., Spec. Hep. **3**: 4. 1905. *Plagiochila amplexifolia* Hampe, in Lindenb. Spec. Hep. 85. 1844. Sur les écorces, bois supérieurs des Bains-Jaunes, bois du Nez-Cassé, *Duss 261.*

DISTRIBUTION: Jamaica, Martinique, St. Vincent, Dominica.

TYLIMANTHUS APPROXIMATUS (Lindenb.) Steph., Spec. Hep. **3**: 7. 1905. *Plagiochila approximata* Lindenb., Spec. Hep. 59. 1844. Sur les arbres de la vallée St. Louis, *Husnot 233* (listed by Husnot as *Gymnanthe approximata* Gott.).

DISTRIBUTION: Brazil, Trinidad, Martinique, Dominica.

TYLIMANTHUS LAXUS (Lindenb.) Spruce, Trans. and Proc. Edinb. Bot. Soc. **15**: 502. 1885. *Plagiochila laxa* Lindenb., Spec. Hep. 148. 1844. Sur les arbres de la Découverte et de la vallée St. Louis, *Husnot 234* (listed by Husnot as *Gymnanthe laxa* Gott.) (Y); without definite locality or number, *Beaupertuis;* sur les arbres de la vallée St. Louis, *L'Herminier 56 pp.;* sur les arbres et les bois pourrissant, Grande-Découverte, Savane-aux-Ananas, Trois-Rivières, *Duss 116,*

260, 424; on rocks, St. Claude, Matouba, *Questel 1588* (P); on rocks, Bains-Jaunes, *Questel 1593* (P).

DISTRIBUTION: Cuba, Martinique, Dominica.

TYLIMANTHUS MARGINATUS Steph., Spec. Hep. **3**: 5. 1905. Without definite locality or number, *L'Herminier;* sur les arbres, Gourbeyre (morne Hirondelle), Bouillante (bois du Trou-aux-Trois-Diables), *Duss 22, 224, 280, 436, 447.*

DISTRIBUTION: Puerto Rico, Martinique, Dominica.

CEPHALOZIACEAE

ADELANTHUS BREVICAULIS Steph., Spec. Hep. **3**: 380. 1908. Described by Stephani without definite locality or number, *Duss.*

DISTRIBUTION: Andes.

ALOBIELLA BIFIDA Steph., in Urban Symb. Antill. **2**: 470. 1900. Bois de Sofaïa, *Duss 49;* morne de Calebasse, *Duss 215;* Saut-de-Bouillante, *Duss 242;* morne Matelyane, *Duss 256.*

DISTRIBUTION: Known only from Guadeloupe.

ALOBIELLA HUSNOTI (Gott.) Schifn., in Engler and Prantl, Natür. Pflanzenfam. 1^3: 98. 1895. *Jungermannia Husnoti* Gott., in Husnot, Revue Bryol. **2**: 2. 1875. Sur les pierres dans le rivière Rouge, *Husnot 242* (listed by Husnot as *Jung. Husnoti* Gott.) (Y); sur la terre humide et les pierres, Rivière Rouge rivière Malanga, *Duss 65C* (Y), *372* (listed by Duss as *Jung. Husnoti* Gott.); sur les arbres du morne Gobelin, *Duss 235.*

DISTRIBUTION: Peru, Puerto Rico, Martinique, Dominica.

ARACHNIOPSIS CONFERVIFOLIA (Gott.) Howe, Bull. Torr. Bot. Club **29**: 288. 1902. *Jungermannia confervifolia* Gott., Hep. Cuben. Wrightianae. Listed by Bescherelle as *Arachniopsis coactilis* Spruce, from Herb. Montagne, but without giving definite locality or name of collector.

DISTRIBUTION: Brazil, Peru, Cuba.

CEPHALOZIA ANTILLANA Besch. et Spruce, Bull. Soc. Bot. Fr. **36** (Congr. Bot): CLXXXIII. 1889. Without definite locality or number, *L'Herminier;* listed by Bescherelle.

DISTRIBUTION: Known only from Guadeloupe.

CEPHALOZIA SANDVICENSIS (Mont.) Spruce, On Cephalozia 46. 1882. *Jungermannia sandvicensis* Mont., Ann. Sci. Nat. Bot. II. **19**: 249. 1843. Without definite locality or number, *L'Herminier;* reported by Stephani in Spec. Hep. **3**: 304. 1908.

DISTRIBUTION: Hawaii, Mexico, Trinidad, Cuba, Puerto Rico.

MARSUPIDIUM BREVIFOLIUM Steph., Spec. Hep. **3**: 388. 1908. Described by Stephani without definite locality or number, *Perrottet.*

DISTRIBUTION: Dominica.

NOWELLIA WRIGHTII (Gott.) Steph., Spec. Hep. **3**: 349. 1908.

Cephalozia Wrightii Gott. in Spruce, Jour. Linn. Soc. Bot. **30**: 354. 1895. Sur les bois pourri, bois des Bains-Jaunes, *Duss 118*.

DISTRIBUTION: Cuba, Dominica.

ODONTOSCHISMA DENUDATUM (Mart.) Dum., Recueil d'Obs. sur les Jung. 19. 1835. *Jungermannia scalaris* var. β. *denudata* Mart., Fl. Crypt. Erlangensis 183. 1817. Without definite locality or number, *L'Herminier;* without definite locality, *Ed. Marie 572* (listed by Bescherelle as *Cephalozia* (*Odontoschisma*) *denudata* Spruce); sur le sol humide, Rivière Noire, près du plateau des Rivières, *Duss 544, 547, 552, 1070*.

DISTRIBUTION: Europe, Asia, North, Central and South America and the Antilles.

ODONTOSCHISMA GUADALUPENSE Steph., Spec. Hep. **3**: 373. 1908. Described by Stephani without definite locality or number, *Duss*.

DISTRIBUTION: Martinique.

ODONTOSCHISMA PLANIFOLIUM Steph., Spec. Hep. **3**: 370. 1908. Described by Stephani without definite locality or number, *Duss*.

DISTRIBUTION: Martinique.

ODONTOSCHISMA PORTORICENSE (Hampe et Gott.) Steph., Hedwigia 27: 296. 1868. *Sphagnoecetis portoricensis* Hampe et Gott., Linnaea 25: 343. 1852. Sur les arbres et les bois pourrissants, bois des Bains-Jaunes, rivière Malanga, bois intérieurs de la Ravine-Chaude, Matouba, *Duss 20, 32, 191*.

DISTRIBUTION: Cuba, Puerto Rico, Martinique.

ODONTOSCHISMA SUBROTUNDIFOLIUM Steph., Spec. Hep. **3**: 371. 1908. Described by Stephani without definite locality or number, *L'Herminier, Husnot, Duss*.

DISTRIBUTION: Jamaica, Dominica.

LEPIDOZIACEAE

BAZZANIA BREUTELIANA (Lindenb. et Gott.) Trevis., Mem. r. Ist. Lomb. III. **4**: 414. 1877. *Mastigobryum Breutelianum* Lindenb. et Gott., G. L. N. Syn. Hep. 226. 1845; Lindenb. Spec. Hep. 75. 1851. Without definite locality or number, *L'Herminier*, listed by Bescherelle as *Mastigobryum Breutelianum* Lindenb. and Gott.; Soufrière, *Questel 1616* (P).

DISTRIBUTION: Cuba, Puerto Rico, St. Kitts, Dominica.

BAZZANIA CUNEISTIPULA (Gott. et Lindenb.) Trevis., Mem. r. Ist. Lonb. III. **4**: 414. 1877. *Mastigobryum cuneistipulum* Gott. et Lindenb., G. L. N. Syn. Hep. 225. 1845. Without definite locality or number, *L'Herminier;* reported by Stephani in Spec. Hep. **3**: 437.

DISTRIBUTION: Jamaica, Puerto Rico, St. Vincent, Martinique, Trinidad.

BAZZANIA FALCATA (Lindenb.) Trevis., Mem. r. Ist. Lomb. III. **4**: 415. 1877. *Mastigobryum falcatum* Lindenb., G. L. N. Syn. Hep. 231.

1845. Reported by Bescherelle as *Mastigobryum tocutianum* Gott. from Herb. Hooker.

DISTRIBUTION: Cuba, St. Vincent.

BAZZANIA **Herminieri** (Steph.) comb. nov. *Mastigobryum Herminieri* Gott., in Husnot, Rev. Bryol. **2**: 3. 1875. Sur les rochers de la Soufrière, *Husnot 211;* without definite locality or number, *Ed. Marie;* sur les arbres, les rochers et les pierres, bois des Bains-Jaunes, environs des sources du Galion, Soufrière, *Duss 98, 102, 122, 302, 310, 328; Duss 1096* as *Mastigobryum bidens* Lindenb. and Gott. (Y); dans les sphagnums, Soufrière, *Duss 1034, 1077,* as *Mastigobryum tenerum* Gott. et Lindenb.; Soufrière, *Questel 1614* (P).

DISTRIBUTION: Martinique.

BAZZANIA HOOKERI (Lindenb.) Trevis., Mem. r. Ist. Lomb. III. **4**: 414. 1877. *Mastigobryum Hookeri* Lindenb., G. L. N. Syn. Hep. 226. 1845. Reported by Bescherelle, from Herb. Hooker, *No. 26* under the name of *Jungermannia trilobata* var. in Herb. Lehm. and Lindenb.; reported by Stephani from material collected by *Ed. Marie,* as *Mastigobryum guadalupense* Steph.; Petit Bourg (Choisi), *Questel 1551* (P); Bains-Jaunes, *Questel 1596* (P).

DISTRIBUTION: Known only from Guadeloupe.

BAZZANIA LONGA (Nees) Trevis., Mem. r. Ist. Lomb. III. **4**: 415. 1877. *Jungermannia longa* Nees, Linnaea **6**: 623. 1833. Sur les arbres, les racines et les pierres, morne l'Echelle, chemin de la Grande-Citerne, *Duss 394;* Soufrière, *Questel 1537* (P).

DISTRIBUTION: Martinique, Dominica, St. Kitts, Jamaica.

BAZZANIA LONGISTIPULA (Lindenb.) Trevis., Mem. r. Ist. Lomb. III. **4**: 415. 1877. *Mastigobryum longistipulum* Lindenb., G. L. N. Syn. Hep. 228. 1845. Without definite locality or number, *L'Herminier,* listed by Bescherelle; sur les arbres, bois supérieurs du Matouba, *Duss 211.*

DISTRIBUTION: Venezuela, Colombia, Peru, Jamaica, Puerto Rico, St. Vincent.

BAZZANIA PORTORICENSIS (Hampe et Gott.) Steph., Hedwigia **27**: 279. 1888. *Mastigobryum portoricense* Hampe et Gott., Linnaea **25**: 348. 1852. Reported by Bescherelle without definite locality, *L'Herminier 64;* sur les arbres, chemin de la Grande-Citerne, bois supérieurs du Matouba, cône de la Soufrière (dans les sphagnums), *Duss 66, 205, 320;* Soufrière, *Questel 1532* (P); Massig Central, in *Sphagnum, Questel 1521* (P).

DISTRIBUTION: Mexico, Costa Rica, Colombia, Brazil, Antilles.

BAZZANIA QUADRICRENATA (Gott.) Pagán, THE BRYOLOGIST **42**: 39. 1939. *Mastigobryum quadricrenatum* Gott., in Stephani, Hedwigia **25**: 206. *pl. 1. f. 1–4.* 1886. Without definite locality or number, *L'Herminier* (listed as *M. quadricrenatum* by Bescherelle).

DISTRIBUTION: Brazil, Venezuela, Puerto Rico, Jamaica.

BAZZANIA SCHWANECKEANA (Hampe et Gott.) Trevis., Mem. r. Ist. Lomb. III. **4**: 414. 1877. *Mastigobryum Schwaneckeanum* Hampe et Gott., Linnaea **25**: 345. 1852. Without definite locality or number, *L'Herminier*, listed by Bescherelle as *Mastigobryum Schwaneckeanum* Hampe. et Gott., sur les vieux arbres, Sainte-Rose, bois de Sofaïa, Pointe-Noire, *Duss 43, 57;* Petit Bourg, *Questel 1571*, 1572 (P).

DISTRIBUTION: Martinique, Dominica, Puerto Rico.

BAZZANIA VARIABILIS (Hampe et Gott.) Steph., Hedwigia **27**: 279. 1888. *Mastigobryum variabile* Hampe et Gott., Linnaea **25**: 348. 1852. On rocks, Soufrière, *Questel 1539, 1608, 1611* (P); without definite locality or number, *L'Herminier;* reported by Stephani in Spec. Hep. **3**: 437.

DISTRIBUTION: Martinique, Puerto Rico.

BAZZANIA VINCENTINA (Lehm. and Lindenb.) Trevis., Mem. r. Ist. Lomb. III. **4**: 414. 1877. *Jungermannia vincentina* Lehm. and Lindenb., Lehm. Pug. Pl. **4**: 59. 1832. Sur les arbres des forêts, *Husnot 212* (Y); reported by Bescherelle from Herb. Montagne as being collected by *Grateloup;* without definite locality, *L'Herminier 55* (listed by Bescherelle); sur les arbres, bois intérieurs de la Pointe-Noire, Gourbeyre, *Duss 282;* Massig Central, in *Sphagnum, Questel 1518* (P).

DISTRIBUTION: Mexico, Guiana, Brazil, Venezuela, Cuba, Puerto Rico, St. Kitts, St. Vincent, Dominica, Martinique, Jamaica.

BAZZANIA WRIGHTII (Gott.) Steph., Hedwigia **27**: 279. 1888. *Mastigobryum Wrightii* Gott., in Stephani, Hedwigia **25**: 237. 1886. Soufrière *Questel 1536* (P).

DISTRIBUTION: Cuba, Puerto Rico.

LEPIDOZIA COMMUTATA Steph., Hedwigia **27**: 293. 1888. Sur les vieux arbres dans les forêts humides, *Husnot 220* (as *L. microphylla* Lindenb.) (Y); without definite locality or number, *L'Herminier*, listed by Bescherelle; sur les arbres de toutes les hautes montagnes, *Duss 163, 268.*

DISTRIBUTION: Costa Rica, British Guiana, West Indies, Martinique.

MICROPTERYGIUM CARINATUM (Grev.) Reimers, Hedwigia **76**: 166. 1936. *Jungermannia carinata* Grev., Ann. Lyceum Nat. Hist. New York. **1**: 276. 1825. *Jungermannia cymbifolia* Hook., in Lehm. Pug. Pl. **6**: 60. 1834. *Micropterygium cymbifolium* Nees, G. L. N. Syn. Hep. 234. 1844. Without definite locality or number, *Ed. Marie;* without definite locality or number, *L'Herminier;* sur les rochers et les écorces d'arbres vivants et morts, Rivière Roche, Lamentin (Ravine-Chaude), Gourbeyre (morne Hirondelle), *Duss 84* (Y) *138, 151, 355, 356, 445.*

DISTRIBUTION: Martinique, Dominica.

MICROPTERYGIUM TRACHYPHYLLUM Reimers var. GUADELOUPENSE

Reimers, Hedwigia **73**: 190. 1933. Without definite locality, *L'Herminier 21, 22, 23,* distributed as *M. vulgare* (Y); Bois des Bains-Jaunes, au dessus du canal Dupuy, sur un bois pourri, *Duss 1024;* Haut Matouba, morne Matelyane, sur un bois pourri, *Duss 1037* (as *M. pterigophyllum* Spruce); sur les arbres, Lamentin (Ravine-Chaude), bois de la rivière Bras-de-Sable, *Duss 40.*

DISTRIBUTION: Martinique.

TELARANEA NEMATODES (Gott.) Howe var. ANTILLANUM (Besch. et Spruce) Howe, Bull. Torr. Bot. Club **29**: 286. 1902. *Blepharostoma antillanum* Besch. et Spruce, Bull. Soc. Bot. Fr. **36** (Congr. Bot.): CLXXXIII. 1889. Sur la terre au bord de la rivière St. Louis, *Husnot 255* (as *Jung. setacea* Web.); Le Gommier, *Ed. Marie 415* (as *Blepharostoma antillanum* Besch. et Spruce) in Bull. Soc. Bot. Fr. **36**: 183. 1889; sur les arbres, bois du Matouba, du Matelyane, de la Grande-Découverte, de la Savane-à-Mulets, etc., *Duss 214, 237* (as *Lepidozia verrucosa* Steph.); sur les arbres, morne Graine-Verte, *Duss 448* (as *Lepidozia chactophylla*).

DISTRIBUTION: Known only from Guadeloupe.

CALYPOGEIACEAE

CALYPOGEIA BIAPICULATA (Spruce) Steph., Spec. Hep. **3**: 403. 1908. *Kantia biapiculata* Spruce, Trans. and Proc. Edinb. Bot. Soc. **15**: 414. 1885. Reported by Stephani without giving definite locality or number, *L'Herminier;* dans les sphagnums, Soufrière, *Duss 1032* (as *Cincinnulus biapiculatus* Spruce); Soufrière, *Questel 1540* (P).

DISTRIBUTION: Mexico, Colombia, Peru, Brazil, Jamaica, Dominica.

CALYPOGEIA CELLULOSA (Spruce) Steph., Spec. Hep. **3**: 398. 1908. *Jungermannia cellulosa* Spreng., Syst. Veg. **4**: 232. 1828. Without definite locality or number, *L'Herminier,* reported by Bescherelle as *Kantia cellulosa* (Spreng.) Spruce; without definite locality or number, *Perrin et L'Herminier;* also reported by Stephani in Spec. Hep. **3**: 398. 1908.

DISTRIBUTION: Venezuela, Peru, Brazil, Antilles.

CALYPOGEIA DUSSIANA Steph., Spec. Hep. **3**: 404. 1908. Described by Stephani without definite locality or number, *Duss.*

DISTRIBUTION: Venezuela.

CALYPOGEIA ELLIOTTII Steph., Spec. Hep., **3**: 395. 1908. Massig Central, in *Sphagnum, Questel 1509* (P).

DISTRIBUTION: Dominica.

CALYPOGEIA MIQUELII Mont., G. L. N. Syn. Hep. 200. 1845. Without definite locality, *L'Herminier 71,* listed by Bescherelle; without definite locality or number, *Ed. Marie,* reported by Bescherelle as *Kantia Miquelii* Mont.; without definite locality or number, *L'Herminier,* reported by Bescherelle and Spruce as *Kantia Miquelii* Mont. var. *oppositifolia* Spruce.

DISTRIBUTION: Tropical America.

CALYPOGEIA PERUVIANA Nees, Hep. Eur. **3**: 26. 1874. Without definite locality or number, *L'Herminier*, reported by Stephani in Spec. Hep. **3**: 411.

DISTRIBUTION: Peru, Guatemala, Colombia.

CALYPOGEIA PORTORICENSIS (Steph.) Evans, THE BRYOLOGIST **10**: 30. 1907. *Kantia portoricensis* Steph., Hedwigia **27**: 280. *pl. 11. f. 1–3.* 1888. Sur les arbres, Gourbeyre (sommet du morne Hirondelle), Vieux-Fort (morne Pavillon), *Duss 2, 27.*

DISTRIBUTION: Jamaica, Puerto Rico, St. Vincent, Dominica.

CALYPOGEIA SUBERECTIFOLIA Steph., Spec. Hep. **3**: 402. 1908. Described by Stephani without giving definite locality or number, *L'Herminier.*

DISTRIBUTION: Dominica.

PTILIDIACEAE

HERBERTA JUNIPERINA (Sw.) Trevis., Mem. r. Ist. Lomb. III. **4**: 397. 1877. *Jungermannia juniperina* Sw., Fl. Ind. Occ. **3**: 1885. 1806. Sur les arbres des forêts, *Husnot 229* (listed by Husnot as *Sendtnera juniperina* Nees); *L'Herminier 44, 53, 71*, reported by Bescherelle as *Schisma juniperina* Dum.; à terre, sur les racines, souvent dans les sphagnums et dans les mousses, morne Goyave, morne d'Echelle, chemin de la Grande-Citerne, Grande-Découverte, etc., *Duss 247, 464* (listed by Duss as *Schisma juniperina* Dum.).

DISTRIBUTION: Jamaica, Puerto Rico, Dominica, St. Vincent, Martinique.

ISOTACHIS AUBERTI (Schwägr.) Steph., Spec. Hep. **3**: 668. 1909. *Jungermannia Auberti* Schwägr., Hist. Musc. Hep. Prodr. 19. 1814. Rochers de la rivière St. Louis, *Husnot 231a* (listed by Husnot as *Isotachis serrulata* Mitt.) (Y); rochers humides, la Soufrière, *Husnot 227* (as *Isotachis serrulata* var. *brasiliana* Gott.); sur les rochers, rivière St. Louis, *Duss 369;* sur les rochers humides, cône de la Soufrière, *Duss 371* (as *I. serrulata* var. *brasiliensis* Gott.); sur les arbres Matouba, morne Papaye, *Duss 224* (as *I. conduplicata* Mitt.).

DISTRIBUTION: Brazil, Martinique, Dominica.

ISOTACHIS BICUSPIDATA Steph., Hedwigia **40**: 471. 1901. Sur les arbres, Sainte-Rose (bois de Sofaïa), *Duss 50, 273, 462*, listed by Duss; sommet de la Soufrière, sur rochers, *Questel 1619* (P).

DISTRIBUTION: Martinique

ISOTACHIS ERYTHRORHIZA (Lehm. et Lindenb.) Trans. and Proc. Edinb. Bot. Soc. **15**: 338. 1885. *Jungermannia erythrorhiza* Lehm. and Lindenb., Lehm. Pug. Pl. **4**: 44. 1832. Rochers de la rivière Rouge, *Husnot 231b* (listed by Husnot as *Jung. erythrorhiza* Lehm. and Lindenb.) (Y); without definite locality, *Beaupertuis 125*, and without definite locality or number, *Ed. Marie*, listed by Bescherelle; sur les parois du canal, la Ravine-Chaude, environs des sources du

Galion, *Duss 80, 254;* without definite locality or number, *L'Herminier* (listed by Bescherelle as *Jungermannia longiretis* Besch. et Spruce); Saut du Matouba, *Questel 1599* (P).

DISTRIBUTION: Puerto Rico, Dominica, Martinique.

ISOTACHIS GUADALUPENSIS Gott., Stephani, Spec. Hep. **3**: 665. 1909. Sur les pierres, les racines et la terre humide, cône de la Soufrière, *Duss 130;* Soufrière, *Questel 1534* (P); Stephani also gives *L'Herminier* as collector.

DISTRIBUTION: Known only from Guadeloupe.

ISOTACHIS HAEMATODES (Lehm. et Lindenb.) Gott., Ann. Sci. Nat. Bot. V. **1**: 122. 1864. *Jungermannia haematodes* Lehm. et Lindenb., G. L. N. Syn. Hep. 129. 1844. La Soufrière, without number, *L'Herminier,* reported by Bescherelle; sur les arbrisseaux, environs des sources du Galion, chemin de la Grande-Citerne, morne l'Echelle, *Duss 106, 216* (Y), *227;* Soufrière, *Questel 1535, 1615* (P).

DISTRIBUTION: Martinique.

ISOTACHIS MASCULA Gott., Ann. Sci. Nat. Bot. V. **1**: 124. 1864. Massig Central, *Questel 1517* (P).

DISTRIBUTION: Peru, Colombia, Brazil, Martinique.

ISOTACHIS TENAX Steph., in Urban Symb. Antill. **3**: 277. 1902. Sur les arbrisseaux, morne l'Echelle, *Duss 550* (Y); Soufrière, *Questel 1538, 1610* (P).

DISTRIBUTION: Known only from Guadeloupe.

TRICHOCOLEA FILICAULIS Steph., Spec. Hep. **4**: 59. 1909. Reported by Stephani without mentioning collector, locality or number.

DISTRIBUTION: Dominica.

TRICHOCOLEA FLACCIDA Spruce, Jour. Linn. Soc. Bot. **30**: 353. 1895. Without definite locality, *Ed. Marie 143* (listed by Bescherelle as *Leiomitra flaccida* Spruce); Massig Central, in *Sphagnum, Questel 1527, 1528* (P).

DISTRIBUTION: Peru, Dominica, Puerto Rico.

TRICHOCOLEA TOMENTOSA (Sw.) Gott., in G. and R. Hep. Eur. exsicc. No. 272. *Jungermannia tomentosa* Sw., Prodr. Fl. Ind. Occ. 145. 1788. Sur les arbres des forêts, *Husnot 219* (Y); without definite locality or number, *Perrottet; L'Herminier 23* (listed by Bescherelle as *Leiomitra tomentosa* Lindenb.); sur les arbres, les rochers, les pierres, abondant sur les hautes montagnes, *Duss 177, 249;* Massig Central, *Questel 1512* (P).

DISTRIBUTION: Ecuador, Colombia, Jamaica, Puerto Rico, St. Vincent, Dominica, Martinique.

SCAPANIACEAE

SCAPANIA RECURVA Steph., Hedwigia **43**: 14. 1904. Reported by Stephani without definite locality or number, *L'Herminier.*

DISTRIBUTION: Known only from Guadeloupe.

RADULACEAE

RADULA ANGULATA Steph., Hedwigia **23**: 114. 1884. Without definite locality or number, *Ed. Marie*, listed by Bescherelle.
DISTRIBUTION: Venezuela.

RADULA CAMPANULATA Lindenb. et Gott., G. L. N. Syn. Hep. 256. 1845. Reported by Stephani in Spec. Hep. **4**: 224. 1910, but without definite locality or name of collector.
DISTRIBUTION: Martinique, Santo Domingo.

RADULA EGGERSIANA Steph., Hedwigia **27**: 302. 1888. Sainte-Rose, *Questel 1547* (P), *1548;* Petit Bourg, *Questel 1568, 1569* (P); Saut du Matouba, *Questel 1598* (P); St. Claude, *Questel 1620* (P).
DISTRIBUTION: Santo Domingo, Martinique.

RADULA DECORA Gott., Hedwigia **23**: 145. 1884. Sur les écorces, Pointe-Noire (morne Belle-Hôtesse), *Duss 128, 150.*
DISTRIBUTION: Venezuela, Martinique.

RADULA FALCIFOLIA Steph., Spec. Hep. **4**: 174. 1910. St. Claude, Matouba, *Questel 1577, 1589* (P); Bains-Jaunes, *Questel 1592* (P).
DISTRIBUTION: Costa Rica.

RADULA FENDLERI Gott., Hedwigia **23**: 146. 1884. Without definite locality or number, reported by Bescherelle; sur les arbres, coulée de la Ravine-à-Déjeuner, au pied de la Grande-Découverte, *Duss 212.*
DISTRIBUTION: Venezuela, Colombia, Dominica, St. Vincent.

RADULA INFLEXA Gott., Hedwigia **23**: 148. 1884. Sur les arbres, Capesterre, bois du Grand-Étang et de l'Étang Zomboi, bois des Bains-Jaunes, *Duss 75, 77, 232, 235, 154.*
DISTRIBUTION: Jamaica, Martinique, Dominica.

RADULA LONGIFOLIA Steph., Spec. Hep. **4**: 181. 1910. Reported by Stephani, without definite locality or name of collector.
DISTRIBUTION: Known only from Guadeloupe.

RADULA PALLENS (Sw.) Nees, G. L. N. Syn. Hep. 256. 1845. *Jungermannia pallens* Sw., Prodr. Fl. Ind. Occ. 143. 1788. Au pied des arbres dans la ravine du Matouba, *Husnot 251;* without definite locality or number, *Grateloup*, in Herb. Montagne, as reported by Bescherelle; *L'Herminier 63, 64;* sur les arbres, dans tous les grands bois de la Guadeloupe, *Duss 53, 72, 371, 432, 443, 444.*
DISTRIBUTION: Widely distributed in tropical America.

RADULA PORTORICENSIS Steph., Hedwigis **27**: 298. 1888. Sur un *Richeria grandis*, Vieux-Fort, *Duss 291;* bois des Bains-Jaunes, *Duss 1017* (Y).
DISTRIBUTION: Jamaica, Santo Domingo, Puerto Rico, St. Vincent.

RADULA SACCATILOBA Steph., Hedwigia **23**: 129. 1884. Sur les rochers, rivière Malanga, *Duss 664.*
DISTRIBUTION: Antilles.

RADULA STENOCALYX Mont., Ann. Sci. Nat. Bot. IV. **3**: 315. 1855. Without definite locality, date or name of collector, as *R. tenella* Gott. (Y).

DISTRIBUTION: Dominica, Trinidad, French Guiana, Brazil, Venezuela, and Africa.

RADULA SUBSIMPLEX Steph., Hedwigia **23**: 130. 1884. Without definite locality or number, *L'Herminier*, reported by Bescherelle.

DISTRIBUTION: Puerto Rico.

RADULA SURINAMENSIS Steph., Hedwigia **23**: 136. 1884. Without definite locality or number, *Ed. Marie*, reported by Bescherelle.

Distribution: Tropical and subtropical America.

RADULA TAYLORI Steph., Hedwigia **23**: 156. 1884. Sur les arbres, morne Graine-Verte, *Duss 452, 468*.

DISTRIBUTION: Demerara.

PORELLACEAE

PORELLA **ramentacea** (Steph.) comb. nov. *Madotheca ramentacea* Steph., Spec. Hep. **4**: 263. 1910. Described by Stephani without definite locality, date, number, or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

LEJEUNEACEAE

ARCHILEJEUNEA HERMINIERI Steph., Spec. Hep. **4**: 714. 1911. Described by Stephani without definite locality, date, number, or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

ARCHILEJEUNEA SACCATILOBA Steph., Hedwigia **34**: 61. 1895. Reported by Stephani in Spec. Hep. **4**: 719, without definite locality, date, number or name of collector.

DISTRIBUTION: Brazil.

BRACHIOLEJEUNEA CORTICALIS (Lehm. et Lindenb.) Schiffn., Hedwigia **23**: 180. 1894. *Jungermannia corticalis* Lehm. et Lindenb., in Lehm. Pug. Pl. **4**: 50. 1832. Sur un rocher, Mageant, *Questel 756* (P).

DISTRIBUTION: Florida, Tropical America, Bahama Islands.

BRYOPTERIS FILICINA (Sw.) Nees, G. L. N. Syn. Hep. 284. 1845. *Jungermannia filicina* Sw., Prodr. Fl. Ind. Occ. 145. 1788. Without definite locality or number, *Husnot* (listed by Bescherelle as *Lejeunea* (*Bryolejeunea*) *filicina* Spruce).

DISTRIBUTION: Widely distributed in tropical America.

BRYOPTERIS TENUICAULIS Tayl., G. L. N. Syn. Hep. 285. 1845. Without definite locality or number, *L'Herminier, Ed. Marie*, listed by Bescherelle as *Lejeunea* (*Bryolojeunea*) *trinitensis* Lehm. and Lindenb.

DISTRIBUTION: Tropical America.

CERATOLEJEUNEA BRASILIENSIS (Gott.) Schiffn., in Engler and Prantl, Natür. Pflanzenfam. 1^3: 125. 1895. *Lejeunea brasiliensis* Gott., G. L. N. Syn. Hep. 398. 1845. Sur les stipes de plusiers espèces de fougères herbacées vivants, cône de la Soufrière, *Duss 1099* (Y).

DISTRIBUTION: Tropical America.

CERATOLEJEUNEA BREVINERVIS (Spruce) Evans, Bull. Torr. Bot. Club **32**: 282. 1905. *Lejeunea* (*Cerato-Lejeunea*) *brevinervis* Spruce, Jour. Linn. Soc. Bot. **30**: 342. *pl. 21. f. 6–9.* 1895. Described by Spruce without definite locality or number, *L'Herminier*.

DISTRIBUTION: Jamaica, Puerto Rico, Dominica.

CERATOLEJEUNEA CERATANTHA (Nees et Mont.) Steph., Spec. Hep. **5**: 401. 1913. *Lejeunea ceratantha* Nees et Mont., Ann. Sci Nat. Bot. II. **14**: 335. 1840. Sur les arbres, Matouba (Rivière Mad. François) *Duss 1046* (Y).

DISTRIBUTION: Brazil, Guiana.

CERATOLEJEUNEA CONNATA Steph., Spec. Hep. **5**: 402. 1913. Sur les feuilles des *Danaea alata*, bois des Bains-Jaunes, de la Sofaïa, de la Ravine-Chaude, *Duss 44* (listed by Duss as *Lejeunea* (*Ceratolejeunea*) *connata* Steph.).

DISTRIBUTION: Martinique, Dominica.

CERATOLEJEUNEA DENTISTIPULA (Gott.) Steph., Spec. Hep. **5**: 407. 1913. *Lejeunea dentistipula* Gott., in herb. Reported by Stephani without definite locality, number or name of collector.

DISTRIBUTION: Cuba.

CERATOLEJEUNEA GUADALUPENSIS Steph., Spec. Hep. **5**: 415. 1913. Described by Stephani without definite locality, number or name of collector.

DISTRIBUTION: Jamaica.

CERATOLEJEUNEA INTEGRIFOLIA Evans, Bull. Torr. Bot. Club **38**: 213. *pl. 9. f. 13–19.* 1911. Boli, *Questel 1559* (P).

DISTRIBUTION: Florida, Bahama Islands, Cuba, Puerto Rico.

CERATOLEJEUNEA INVOLVENS (Nees et Mont.) Steph., Spec. Hep. **5**: 419. 1913. *Lejeunea involvens* Nees et Mont., Ann. Sci. Nat. Bot. II. **14**: 336. 1840. Sur les arbres et les arbrisseaux, Savane-à-Mulets, Vieux-Fort (morne Pavillon), *Duss 189, 193, 302* (Y), listed by Duss as *Lejeunea* (*Ceratolejeunea*) *involvens*.

DISTRIBUTION: Tropical America.

CERATOLEJEUNEA PATENTISSIMA (Hampe et Gott.) Evans, Bull. Torr. Bot. Club **32**: 286. *pl. 20. f. 19–26.* 1905. *Lejeunea patentissima* Hampe et Gott., Linnaea **25**: 355. 1852. Reported by Stephani, in Spec. Hep. **5**: 258, as *Harpalejeunea patentissima* (Gott. et Hampe) Steph., but without definite locality, number or name of collector.

DISTRIBUTION: Cuba, Puerto Rico, Jamaica.

CERATOLEJEUNEA SCABERULA (Spruce) Steph., Spec. Hep. **5**: 439. 1913. *Lejeunea* (*Priono-Lejeunea*) *scaberula* Spruce, Trans. and Proc. Edinb. Bot. Soc. **15**: 154. 1884. Reported by Stephani as *Prionolejeunea scaberula*, but without definite locality or name of collector.

DISTRIBUTION: Brazil, Rio Negro, Dominica.

CERATOLEJEUNEA SCHWANECKEI Steph., Hedwigia **34**: 237. 1895. Reported by Stephani, in Spec. Hep. **5**: 440, without definite locality, number or name of collector: Massig Central, *Questel 1515* (P); Petit Bourg, *Questel 1565* (P).

DISTRIBUTION: Puerto Rico, Cuba.

CERATOLEJEUNEA SPINOSA (Gott.) Steph., Hedwigia **34**: 238. 1895. *Lejeunea spinosa* Gott., G. L. N. Syn. Hep. 402. 1845. Without definite locality, *L'Herminier*, reported by Bescherelle from material in Herb. Martius; Massig Central, in *Sphagnum*, *Questel 1507*, *1508*, *1516* (P).

DISTRIBUTION: Cuba, Puerto Rico, Martinique, St. Kitts, Dominica.

CERATOLEJEUNEA VARIABILIS (Lindenb.) Schiffn., in Engler and Prantl, Natür. Pflanzenfam. 1^3: 125. 1895. *Lejeunea variabilis* Lindenb., G. L. N. Syn. Hep. 399. 1845. Without definite locality, or number, *L'Herminier*, listed by Bescherelle; sur les arbres, Savane-aux-Ananas, Matouba, Vieux-Fort (sommet du morne Pavillon), *Duss 196*, *229*, *328*, listed by Duss as *Lejeunea* (*Ceratolejeunea*) *variabilis* Spruce.

DISTRIBUTION: Brazil, Cuba, Puerto Rico, Martinique, St. Vincent, St. Kitts, Dominica.

CHEILOLEJEUNEA DUSSII. Steph., in Duss, Énum. Méthod. Musc. Antill. Fr. **1**: 13. 1903. Sur les arbres, Gourbeyre (morne Hirondelle), *Duss 290*, *430*, *500* (Y), listed by Duss as *Lejeunea* (*Cheilolejeunea*) *Dussii* Steph.

DISTRIBUTION: Known only from Guadeloupe.

CHEILOLEJEUNEA LURIDA (Lindenb.) Steph., Spec. Hep. **5**: 658. 1914. *Lejeunea lurida* Lindenb., G. L. N. Syn. Hep. 379. 1845. Sur les troncs des vieux arbres, bois des Bains-Jaunes, *Duss 103* listed by Duss as *Lejeunea* (*Cheilolejeunea*) *lurida* Spruce.

DISTRIBUTION: Brazil.

CHEILOLEJEUNEA FALCATA Steph., Spec. Hep. **5**: 655. 1914. Sur l'écorce de différents arbres, Gourbeyre (morne Hirondelle), *Duss 438*, *499* (Y), listed by Duss as *Lejeunea* (*Cheilolejeunea*) *falcata* Steph.

DISTRIBUTION: Known only from Guadeloupe.

CHEILOLEJEUNEA OVISTIPULA Steph., Hedwigia **34**: 244. 1895. Described by Stephani without definite locality or number, *L'Herminier*.

DISTRIBUTION: Known only from Guadeloupe.

COLURA LYRATA Steph., Hedwigia **40**: 471. 1901. Sur l'écorce d'un

arbre mort, bois du Nez-Cassé, *Duss 158*, listed by Duss as *Lejeunea* (*Colurolejeunea*) *lyrata* Steph.

DISTRIBUTION: Known only from Guadeloupe.

CROSSOTOLEJEUNEA BORYANA (Mont.) Schiffn., in Engler and Prantl, Natür. Pflanzenfam. 1^3: 127. 1895. *Lejeunea Boryana* Mont., Ann. Sci. Nat. Bot. II. **9**: 35. 1838. Without definite locality, *L'Herminier 19, 554* (Y); sur les arbres et les rochers, Capesterre (bois du Grand-Étang), *Duss 147*.

DISTRIBUTION: Brazil, Guiana, Peru, West Indies, Martinique.

CROSSOTOLEJEUNEA CONTROVERSA Gott., Steph. Spec. Hep. **5**: 230. 1913. Reported by Stephani, without definite locality, number or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

CROSSOTOLEJEUNEA CRENATA (Mont. et Nees.) Steph., Spec. Hep. **5**: 230. 1913. *Lejeunea crenata* Mont. et Nees, G. L. N. Syn. Hep. 341. 1845. Reported by Stephani without definite locality, number or name of collector.

DISTRIBUTION: Guiana, Trinidad.

CROSSOTOLEJEUNEA PAUCISPINA (Spruce) Steph., Hedgiwia **35**: 76. 1896. *Lejeunea* (*Crossoto-Lejeunea*) *paucispina* Spruce, Trans. and Proc. Edinb. Bot. Soc. **15**: 163. 1884. Reported by Bescherelle, from Herb. Montagne, without giving definite locality or number.

DISTRIBUTION: Brazil, Trinidad.

CYCLOLEJEUNEA ACCEDENS (Gott.) Evans, Bull. Torr. Bot. Club **31**: 201. *pl. 9. f. 17–23.* 1904. *Lejeunea accedens* Gott., G. L. N. Syn. Hep. 339. 1845. Sur les feuilles de *Trichomanes*, chemin des Bains, Matouba, *Husnot 252b;* sur la terre humide, les rochers et les feuilles, Matouba, Matelyane, chemin de la Ravine-à-Déjeuner, Capesterre (bois du Grand-Étang, *Duss 380*.

DISTRIBUTION: Peru, Bolivia, Puerto Rico, St. Vincent, St. Kitts, Dominica.

CYCLOLEJEUNEA CHITONIA (Tayl.) Evans, Bull. Torr. Bot. Club **31**: 184. *pl. 8. f. 16–23.* 1904. *Lejeunea chitonia* Tayl., Lehm. Pug. Pl. **8**: 27. 1844. Sur les feuilles d'un *Nectandra membranacea*, Gourbeyre, morne Hirondelle, *Duss 493*, listed by Duss as *Lejeunea* (*Odontolejeunea*) *subbifida* Step.; plateau des Rivières in cortice arboris, *Duss 513* (as *Odontolejeunea subbifida* Steph.).

DISTRIBUTION: Venezuela, Jamaica, Puerto Rico, British Guiana, St. Vincent, Martinique.

CYCLOLEJEUNEA CONVEXISTIPA (Lehm. et Lindenb.) Evans, Bull. Torr. Bot. Club **31**: 198. *pl. 9. f. 1–6.* 1904. *Jungermannia convexistipa* Lehm. et Lindenb., Lehm. Pug. Pl. **6**: 43. 1834. Reported by Bescherelle without definite locality, *L'Herminier*, from material in *Herb. Mougeot, no. 272 pp.*, under the name of *Lej. Mougeotii* Lindenb.; sur les feuilles vertes, Gourbeyre, sommet du morne Hirondelle,

chemin des Bains-jaunes, à la Savane-à-Mulets, *Duss 54* (Y), *79, 187, 487;* sur les feuilles des différents arbres vivants, Lamentin, bois de la Ravine-Chaude et de l'intérieur de la rivière Bras-de-Sable, *Duss 68* (listed by Duss as *Odontolejeunea Mougeotii* Lindenb.); Massig Central, *Questel 1519* (P).

DISTRIBUTION: Widely distributed in tropical America.

CYCLOLEJEUNEA MIMULA Steph., Spec. Hep. **5**: 192. 1913 *Odontolejeunea mimula* Steph., Hedwigia **35**: 116. 1896. Sur les feuilles de *Danaea,* rivière aux excrévissés près de Matouba, *Husnot 252a* (listed as *Lej. mimula* Gott. by Husnot); also reported by Stephani without definite locality, number or name of collector.

DISTRIBUTION: Guiana, Martinique.

CYCLOLEJEUNEA SPECTABILIS Steph., Spec. Hep. **5**: 193. 1913. Reported by Stephani, but without definite locality, number or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

CYSTOLEJEUNEA LINEATA (Lehm. et Lindenb.) Evans, Bull. Torr. Bot. Club **33**: 17. *pl. 3. f. 1–19.* 1906. *Jungermannia lineata* Lehm. et Lindenb., Lehm. Pug. Pl. **4**: 53. 1832. Reported by Bescherelle as *Lejeunea* (*Cheilolejeunea*) *lineata* (Lehm. and Lindenb.), but without definite locality or number, *L'Herminier;* sur les arbres, bois de Matelyane, *Duss 452,* listed by Duss as *Lejeunea* (*Cheilolejeunea*).

DISTRIBUTION: Puerto Rico, Martinique, St. Kitts, St. Vincent, Dominica.

DICRANOLEJEUNEA AXILLIARIS (Nees et Mont.) Schiffn., in Engler and Prantl, Natür. Pflanzenfam. 1^3: 128. 1895. *Lejeunea axillaris* Nees et Mont., Ann. Sci. Nat. Bot. II. **5**: 59. 1836. Dans les sphagnums, Soufrière, *Duss 1033.*

DISTRIBUTION: West Indies and Mexico, through Central America and the Andes into Chile.

DIPLASIOLEJEUNEA PELLUCIDA (Meissn.) Schiffn., in Engler and Prantl, Natür. Pflanzenfam. 1^3: 121. 1895. *Jungermannia pellucida* Meissn., Spreng., in Linnaeus, Syst. Veg. ed. 16. 4^2: 325. 1827. Sur les feuilles des différents arbres et sur les écorces, Bouillante (Trou-aux-Trois-Diables), Gourbeyre (morne Hirondelle), *Duss 33, 70* (Y), *497, 498,* listed by Duss as *Lejeunea* (*Diplosiolejeunea*) *pellucida* Spruce.

DISTRIBUTION: Central and South America, Antilles, East Indies.

DIPLASIOLEJEUNEA GUADALUPENSIS Steph., Spec. Hep. **5**: 924. 1916. Described by Stephani without definite locality, date, or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

DIPLASIOLEJEUNEA UNIDENTATA (Lehm. et Lindenb.) Schiffn., Bot. Jahrb. **23**: 583. 1897. *Jungermannia unidentata* Lehm. et Lindenb., in Lehm. Pug. Pl. **6**: 48. 1834. Sur les branches d'un *Clusia rosea,*

morne Gommier dans un endroit très ouvert, *Duss 4*, listed by Duss as *Lejeunea (Diplosiolejeuna) unidentata* Steph.

DISTRIBUTION: Jamaica, Puerto Rico, Martinique, Dominica, St. Vincent.

DREPANOLEJEUNEA INCHOATA (Meissn.) Schiffn., in Engler and Prantl, Natür. Pflanzenfam. 1^3: 126. 1895. *Jungermannia inchoata* Meissn., Lehm. Pug. Pl. **5**: 19. 1833. Sur frondes de fougères, in *Herb. Mougeot No. 271*, reported by Bescherelle as *Lejeunea (Drepanolejeunea) inchoata* Spruce.

DISTRIBUTION: West Indies, Costa Rica and several other localities in tropical and subtropical America.

DREPANOLEJEUNEA TRIGONOPHYLLA Steph., Hedwigia **35**: 85. 1896. Described by Stephani without definite locality, date or number, but collected by *L'Herminier*.

DISTRIBUTION: Martinique.

EUOSMOLEJEUNEA CLAUSA (Nees et Mont.) Evans, THE BRYOLOGIST **11**: 69. 1908. *Lejeunea clausa* Nees et Mont., Ann. Sci. Nat. Bot. II. **14**: 337. *pl. 20. f. 3.* 1840. Sur les arbres, le Vauquelin, le camp Balata, *Husnot 236;* Petit Bourg, *Questel 1566* (P); St. Claude, *Questel 1574, 1576* (P); H. Stehlé *525* (Y).

DISTRIBUTION: Widely distributed in tropical and subtropical America.

EUOSMOLEJEUNEA DURIUSCULA (Ness) Evans, Mem. Torr. Bot. Club **8**: 135. *pl. 18. f. 12–23.* 1902. *Lejeunea duriuscula* Nees, G. L. N. Syn. Hep. 364. 1845. Sur les arbres vivants ou pourris, Gourbeyre, bois du morne Hirondelle, *Duss 93*, listed by Duss as *Lejeunea (Cheilolejeunea) duriuscula* Spruce.

DISTRIBUTION: Southern United States and tropical America.

EUOSMOLEJEUNEA TRIFARIA (Reinw., Bl. et Nees) Steph., Hedwigia **27**: 292. 1888. *Jungermannia trifaria* Reinw., Bl. et Nees, Nova Acta Acad. Caes.-Leop. **12**: 226. *No. 38.* 1825. Reported by Bescherelle, from material in *Herb. Hooker*, as *Lejeunea (Euosmolejeunea) trifaria* Spruce; Sainte-Rose, bois de Sofaïa, sur les arbres le long d'un ruisseau, rivière au Ecrévissés, *Duss 5a, 63, 67, 257;* Massig Central *Questel 1510* (P); St. Rose, *Questel 1549* (P); Petit Bourg, *Questel 1554* (P); Boli, *Questel 1556, 1558, 1560, 1562* (P); St. Claude, *Questel 1580* (P); Vieux Habitants, *Questel 1601, 1605, 1606* (P).

DISTRIBUTION: Widely distributed in tropical regions.

HARPALEJEUNEA PREACUTA (Gott.) Steph., Spec. Hep. **5**: 257. 1913. *Lejeunea praeacuta* Gott. Mst. Reported by Stephani without definite locality, number or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

HARPALEJEUNEA SPORADIA (Besch. et Spruce) Steph., Spec. Hep. **5**: 259. 1913. *Lejeunea (Harpalejeunea) sporadia* Besch. et Spruce, Bull. Soc. Bot. Fr. 36 (Congr. Bot.): CLXXX. 1889. Reported by

Bescherelle without definite locality or number, collected by *Ed. Marie* in 1877, on rotten trunks.

DISTRIBUTION: Known only from Guadeloupe.

HARPALEJEUNEA TRIDENS (Besch. et Spruce) Steph., Spec. Hep. **5**: 263. 1913. *Lejeunea* (*Harpalejeunea*) *tridens* Besch. et Spruce, Bull. Soc. Bot. Fr. (Congr. Bot.) **36**: CLXXXI. 1889. Reported by Bescherelle as collected by *Husnot No. 238a*, and mixed with *Lej. filiformis*.

DISTRIBUTION: Dominica.

HYGROLEJEUNEA CERINA (Lehm. et Lindenb.) Steph., Spec. Hep. **5**: 543. 1914. *Lejeunea cerina* Lehm. et Lindenb., G. L. N. Syn. Hep. 391. 1845. Sur les arbres bord du chemin des Bains Chauds du Matouba, *Husnot 241b* (Y), listed by Husnot as *Lejeunea cerina* Lehm. and Lindenb; sur les feuilles des fougères et les branches des arbres, chemin des sources du Galion à la Savane-à-Mulets, Gourbeyre, morne Gobelin, *Duss 94*.

DISTRIBUTION: Brazil, West Indies, Martinique.

HYGROLEJEUNEA ORBA (Gott.) Steph., Spec. Hep. **5**: 547. 1914. *Lejeunea orba* Gott., G. L. N. Syn. Hep. 352. 1845. Sur l'écorce d'arbres vivants et morts, Saut-de-Bouillante, morne Diable, habitation Maler, *Duss 337* (Y).

DISTRIBUTION: Common in tropical America.

LEJEUNEA FLAVA (Sw.) Nees, Naturgesch. Eur. Leberm. **3**: 277. 1838. *Jungermannia flava* Sw., Prodr. Fl. Ind. Occ. 144. 1788. Petit Bourg, *Questel 1564* (P).

DISTRIBUTION: Widely distributed in tropical regions.

LEJEUNEA SMARAGDINA (Besch. et Spruce) Steph., Spec. Hep. **5**: 761. 1915. *Lejeunea* (*Eulejeunea*) *smaragdina* Besch. et Spruce, Soc. Bot. Fr. **36**. (Congr. Bot.): CLXXXII. 1889. Listed by Bescherelle as *Lejeunea* (*Eulejeunea*) *smaragdina* Besch. et Spruce without definite locality, *L'Herminier 70;* sur les bois pourri, lit de la rivière Noire, *Duss 183*.

DISTRIBUTION: Known only from Guadeloupe.

LEUCOLEJEUNEA XANTHOCARPA (Lehm. et Lindenb.) Evans, Torreya **7**: 229. 1908. *Jungermannia xanthocarpa* Lehm. et Lindenb., Lehm. Pug. Pl. **5**: 8. 1832. Sur le Recou, le camp Jacob et le Matouba, *Husnot 253*, listed as *Lejeunea xanthocarpa* Lehm. and Lindenb. by Husnot; sur les arbres et les racines, Matouba (ravine Flore, rivière Mad. François au dessus de l'habitation Planel), Savane-à-Mulets, Camp Jacob, bois de la Cascade de Vauchelet, *Duss 14, 71 (Y), 123, 222, 496*, listed by Duss as *Lejeunea* (*Archilejeunea*) *xanthocarpa* Pears.

DISTRIBUTION: Florida, Antilles, South America, So. Africa, Java.

LOPHOLEJEUNEA HERMINIERI (Gott.) Steph., Spec. Hep. **5**: 75. 1912. *Lejeunea Herminieri* Gott., Steph. *l. c.* (as synonym). Re-

ported by Stephani, without definite locality, number, or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

LOPHOLEJEUNEA MARIEI (Besch. et Spruce) Steph., Spec. Hep. **5**: 72. 1912. *Lejeunea* (*Lopholejeunea*) *Marici* Besch. et Spruce, Soc. Bot. Fr. **36** (Congr. Bot.): CLXXIX. 1898. Reported by Bescherelle without definite locality or number, collected by *Ed. Marie*.

DISTRIBUTION: Known only from Guadeloupe.

LOPHOLEJEUNEA SAGRAEANA (Mont.) Schiffn., in Engler and Prantl, Natür. Pflanzenfam. 1^3: 129. 1895. *Phragmicoma Sagraeana* Mont., in Ramón de la Sagra, Hist. fis. pol. y natur. Cuba **9**: 464. *pl. 18. f. 1.* 1845. Sur le Recou, le Camp Jacob et le Matouba, *Husnot 254*, listed by Husnot as *Lejeunea Sagraeana* Mont.; sur la terre humide, sur les écorces d'arbres vivants et morts, Matelyane Sainte-Rose, bois de Sofaïa, *Duss 45*.

DISTRIBUTION: Florida, Mexico, Brazil, Bolivia, West Indies, St. Vincent, Martinique, East Indies, Africa.

MACROLEJEUNEA SUBSIMPLEX (Mont.) Schiffn., in Engler and Prantl, Natür. Pflanzenfam. 1^3: 125. 1895. *Lejeunea subsimplex* Mont., Ann. Sci. Nat. Bot. II. **19**: 264. 1843. Sur la terre et les vieux arbres, la ravine du Matouba Rivière Rouge, *Husnot 239* (Y), 241a (listed by Husnot as *Lej. subsimplex* Mont.); sur les arbres et arbrisseaux, Trois-Rivières, bois de la Madeleine, *Duss 419;* rampant sur les écorces lisses des *Myrcia* et *Calyptranthes*, Gourbeyre (les Palmistes), Bouillante (Trou-aux-Trois-Diables), chemin du Galion à la Grande-Citerne, etc., *Duss 29, 104, 141, 276, 306, 495, 1104* (Y) (listed by Duss as *Lejeunea* (*Taxilejeunea*) *subsimplex*); Petit Bourg, *Questel 1544, 1567* (P).

DISTRIBUTION: Widely distributed in the West Indies, South America, Mexico, Dominica, Martinique, Galapagos Islands.

MARCHESINIA CRUEGERI (Lindenb.) Steph., Spec. Hep. **5**: 151. 1912. *Lejeunea Cruegeri* Lindenb., G. L. N. Syn. Hep. 319. 1845. Reported by Stephani without definite locality, number or name of collector.

DISTRIBUTION: Brazil, Guiana, Trinidad.

MARCHESINIA PSEUDOCUCULLATA (Gott.) Steph., Spec. Hep. **5**: 149. 1912. *Lejeunea pseudocucullata* Gott., Steph., *l. c.* (as synonym). Reported by Stephani without definite locality, date, number or name of collector.

DISTRIBUTION: Guiana, Cuba and Santo Domingo.

MICROLEJEUNEA LAETEVIRENS (Nees et Mont.) Evans, THE BRYOLOGIST **11**: 68. 1908. *Lejeunea lacte-virens* Nees et Mont., in Ramón de la Sagra, Hist. fisc. pol. y nat. Cuba **9**: 469. 1845. Reported by Stephani, in Spec. Hep. **5**: 737, as *Lejeunea glaucophylla* Gott.; on decaying stump, Vieux Habitants, *Questel 1604* (P).

DISTRIBUTION: Virginia, Florida to Louisiana, tropical America.

NEUROLEJEUNEA BREUTELII (Gott.) Evans, Bull. Torr. Bot. Club **34**: 13. *pl. 1. f. 17–23.* 1907. *Lejeunea Breutelii* Gott., G. L. N. Syn. Hep. 324. 1845. Reported by Bescherelle as *Lejeunea* (*Ceratolejeunea*) *Breutelii* Gott., but without definite locality, number, collected by *Ed. Marie;* sur les arbres vivants et morts, morne Gommier, environs des sources du Galion, Savane-aux-Ananas, bois du Nez-Cassé, Bouillante (Trou-aux-Trois-Diables), Savane-à-Mulets, *Duss 5, 54, 160, 234, 250, 429, 1022* (Y); St. Claude, *Questel 1573* (P).

DISTRIBUTION: Jamaica, Puerto Rico, Martinique, St. Kitts, Dominica.

ODONTOLEJEUNEA LUNULATA (Web.) Schiffn., in Engler and Prantl, Natür. Pflanzenfam. 1^3: 128. 1895. *Jungermannia lunulata* Web., Hist. Musc. Hep. Prodr. 33. 1815. Reported by Bescherelle without definite locality, from *Herb. Mougeot No. 272 pp.* as *Lejeunea* (*Odontolejeunea*) *lunulata* Spruce; sur les feuilles des différents arbres et arbrisseaux, Bouillante (Trou-aux-Trois-Diables), Vieux-Forts (morne Pavillon), *Duss 56.*

DISTRIBUTION: Widely distributed in tropical America, also found in Africa.

ODONTOLEJEUNEA SIEBERIANA (Gott.) Schiffn., in Engler and Prantl, Natür. Pflanzenfam. 1^3: 127. 1895. *Lejeunea Sieberiana* Gott., G. L. N. Syn. Hep. 328. 1845. Sur les feuilles des différents arbres, morne Graine-Verte, *Duss 449,* listed by Duss.

DISTRIBUTION: Mexico, Central and South America and the Antilles.

ODONTOLEJEUNEA TOCORIENSIS Steph., Hedwigia **35**: 117. 1896. Sur les feuilles d'un *Carludovica plumieri,* les Palmistes, *Duss 303;* also reported by Stephani in Spec. Hep. **5**: 174. 1912.

DISTRIBUTION: Costa Rica, Ecuador.

OMPHALANTHUS FILIFORMIS (Sw.) Nees, G. L. N. Syn. Hep. 304. 1845. *Jungermannia filiformis* Sw., Prodr. Fl. Ind. Occ. 144. 1788. Sur les arbres, La Découverte, *Husnot 238;* sur les arbres, Savane-aux-Ananas, Savane-à-Mulets, Sainte-Rose (bois de Sofaïa), Vieux-Fort (morne Pavillon), *Duss 111, 319a, 491;* Massig Central, *Questel 1513* (P).

DISTRIBUTION: Jamaica, Puerto Rico, St. Kitts, Dominica, Martinique; also reported from the Galapagos Islands.

PRIONOLEJEUNEA AEMULA (Gott.) Evans, Bull. Torr. Bot. Club **31**: 219. *pl. 11. f. 18–23.* 1904. *Lejeunea aemula* Gott., G. L. N. Syn. Hep. 338. 1845. Without definite locality, collected by *L'Herminier* and distributed as the type of *P. bicristata.* The specimen seen is in the herbarium of Yale University.

DISTRIBUTION: Puerto Rico, St. Kitts, Dominica.

PRIONOLEJEUNEA ALATIFLORA Steph., Hedwigia **40**: 472. 1901. Sur les arbres pourrissant, Bouillante (Trou-aux-Trois-Diables). *Duss 246,* listed as *Lejeunea* (*Prionolejeunea*) *alatiflora* by Duss.

DISTRIBUTION: Known only from Guadeloupe.

PRIONOLEJEUNEA DECORA (Tayl.) Steph., Spec. Hep. **5**: 207. 1913. *Lejeunea decora* Tayl., Lond. Jour. Bot. 5: 393. 1846. Reported by Bescherelle without definite locality or number, collected by *L'Herminier*.

DISTRIBUTION: Jamaica, Dominica.

PRIONOLEJEUNEA GERMANI (Gott.) Steph., Spec. Hep. **5**: 219. 1913. *Lejeunea Germani* Gott. Steph. *l. c.* (as synonym). Reported by Stephani without giving definite locality or name of collector. (*Germain?*)

DISTRIBUTION: Known only from Guadeloupe.

PRIONOLEJEUNEA GLAUCA Steph., Spec. Hep. **5**: 219. 1913. Reported by Stephani without definite locality, or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

PRIONOLEJEUNEA GROSSEPAPULOSA Steph., Spec. Hep. **5**: 220. 1913. Reported by Stephani without definite locality, or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

PRIONOLEJEUNEA GUADALUPENSIS (Lindenb.) Steph., Spec. Hep. **5**: 211. 1913. *Lejeunea guadalupensis* Lindenb., G. L. Syn. Hep. 340. 1845. Reported by Bescherelle without definite locality, *L'Herminier*.

DISTRIBUTION: West Indies, Dominica, St. Vincent, Martinique.

PRIONOLEJEUNEA MEISSNERII (Gott.) Steph., Spec. Hep. **5**: 212. 1913. *Lejeunea Meissnerii* Gott., G. L. N. Syn. Hep. 340. 1845. Sur les racines, Bouillante (Trou-aux-Trois-Diables), *Duss 34* (listed by Duss as *Lejeunea* (*Prionolejeunea*) *Meissneri*).

DISTRIBUTION: Tropical America.

PRIONOLEJEUNEA PRIONODES Steph., Hedwigia **35**: 119. 1896. Described by Stephani as being collected by *L'Herminier*, but without giving definite locality.

DISTRIBUTION: Brazil.

PTYCHOCOLEUS POLYCARPUS (Nees) Trevis., Mem. r. Ist. Lomb. III. **4**: 405. 1877. *Jungermannia polycarpa* Nees, in Martius Fl. Bras. **1**[1]: 350. 1833. Sur les arbres, Gourbeyre, *Duss 88, 91* (Y).

DISTRIBUTION: Mexico, Brazil, Cuba, Jamaica, Santo Domingo, Puerto Rico.

PYCNOLEJEUNEA DUSSIANA Steph., in Urban, Symb. Antill. **3**: 278. 1902. Sur l'écorce d'un arbre pourrissant, Matouba, près de la rivière Rouge, *Duss 699* (Y).

DISTRIBUTION: Known only from Guadeloupe.

RECTOLEJEUNEA DUSSII Steph., Spec. Hep. **5**: 685. 1914. Described by Stephani without definite locality, or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

RECTOLEJEUNEA FLAVICANS Steph., Spec. Hep. **5**: 687. 1914. Described by Stephani without definite locality, or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

STICTOLEJEUNEA SQUAMATA (Willd.) Schiffn., in Engler and Prantl, Natür. Pflanzenfam. 1^3: 131. 1895. *Jungermannia squamata* Willd., Web. Hist. Musc. Hepat. Prodr. 33. 1815. Sur l'écorce d'un *Guazuma ulmifolia* pourrissant, Capesterre, bois du Grand-Étang, *Duss 139, 451.*

DISTRIBUTION: Costa Rica, Brazil, Cuba, Jamaica, Haiti, Puerto Rico, St. Vincent, Dominica, Martinique.

STREPSILEJEUNEA INFLEXA (Hampe) Pears., Jour. Bot. **60**: 223. 1922. *Lejeunea inflexa* Hampe, in Lehm. Pug. Pl. **7**: 22. 1838. Sur les arbres de la Découverte, *Husnot 238b* (listed as *Lejeunea inflexa* Hpe. by Husnot); sur les bois pourri dans le lit de la rivière Rouge, bois des Bains-Jaunes, *Duss 485, 437* (listed by Duss as *Lejeunea* (*Strepsilejeunea*) *inflexa* Spruce); chemin de la Grande-Citerne, *Duss 89*, listed as *Lejeunea* (*Prionolejeunea*) *inflexa* Spruce.

DISTRIBUTION: Tropical America.

STREPSILEJEUNEA LOBULATA (Lindenb.) Steph., Spec. Hep. **5**: 284. 1913. *Lejeunea lobulata* Lindenb., G. L. N. Syn. Hep. 353. 1845. Reported by Stephani without definite locality or name of collector.

DISTRIBUTION: St. Kitts.

SYMBIEZIDIUM BARBIFLORUM (Lindenb. et Gott.) Evans, Bull. Torr. Bot. Club **34**: 540. *pl. 31. f. 11–14.* 1908. *Lejeunea barbiflora* Lindenb. et Gott., Linnaea **24**: 630. 1851. Reported by Bescherelle as *Lejeunea* (*Platylejeunea*) *barbiflora*, collected by *Ed. Marie, No. 73;* without definite locality, *Ed. Marie*, listed by Bescherelle as *Lejeunea* (*Platylejeunea*) *incrassata* (Tayl.); sur l'écorce des vieux arbres, bois des Bains-Jaunes, *Duss 503*, as *Lejeunea* (*Platylejeunea*) *barbiflora* Steph.

DISTRIBUTION: Dutch Guiana, Cuba, Puerto Rico.

SYMBIEZIDIUM GRANULATUM (Nees) Trevis., Mem. r. Ist. Lomb. III. **4**: 403. 1877. *Jungermannia granulata* Nees, in Martius Fl. Bras. 1^1: 352. 1833. Sur l'écorce des vieux arbres, Vieux-Forts, bois du morne Pavillon; Gourbeyre, les Palmistes; chemin des Bains-Jaunes à la Savane-à-Mulets, *Duss 10, 30, 301, 482, 483* (listed by Duss as *Lejeunea* (*Platylejeunea*) *granulata* Steph.).

DISTRIBUTION: Brazil, Dutch Guiana, Ecuador, St. Vincent, Puerto Rico.

SYMBIEZIDIUM VINCENTINUM (Gott.) Trevis, Mem. r. Ist. Lomb. III. **4**: 403. 1877. *Lejeunea vincentina* Gott., G. L. N. Syn. Hep. 313. 1845. Sur les troncs pourris, Matouba, Bains Chaude du Matouba, la Découverte, *Husnot 226,* listed by Husnot as *Lej. vincentina* Gott.; rampant sur les écorces des vieux arbres, bois du Matouba, du morne Papaye, *Duss 204, 274* (listed as *Lejeunea* (*Platylejeunea*) *vincentina*).

DISTRIBUTION: Tropical America.

TAXILEJEUNEA BIAPICULATA Steph., Spec. Hep. **5**: 460. 1913. Sur les arbres, bois du Saut-de-Bouillante, *Duss 400,* listed by Duss as *Lejeunea* (*Taxilejeunea*) *biapiculata* Spruce.

DISTRIBUTION: Dominica.

TAXILEJEUNEA DEBILIS (Lehm. et Lindenb.) Steph., Spec. Hep. **5**: 451. 1913. *Jungermannia debilis* Lehm. et Lindenb., Lehm. Pug. Pl. 4: 51. 1832. Reported by Bescherelle without definite locality or date, *L'Herminier,* as *Lejeunea* (*Taxilejeunea*) *martinicensis* Lindenb.; sur les arbres, les racines, d'abord rampant, ensuite pendant, Haut-Matouba, Grande-Découverte, chemin du Matelyane à la Savane-aux-Ananas, etc., *Duss 8, 179, 210* (listed by Duss as *Lejeunea* (*Taxilejeunea*) *debilis* Steph.); sur les arbres, Matelyane, Savane-aux-Ananas, *Duss 377, 378,* listed as *Lejeunea* (*Taxilejeunea*) *martinicensis* (Gott.) by Duss; sur les arbres, bois des Bains-Jaunes, sommet du Grand-Marran, *Duss 1026* (Y), listed as *Taxilejeunea caripensis* Gott. by Duss.

DISTRIBUTION: Widely distributed in tropical America.

TAXILEJEUNEA IRREGULARIS Steph., Spec. Hep. **5**: 490. 1914. Described by Stephani without definite locality or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

TAXILEJEUNEA LINGUAEFOLIA Steph., Spec. Hep. **5**: 471. 1913. Described by Stephani without definite locality or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

TAXILEJEUNEA SULPHUREA (Lehm. et Lindenb.) Schiffn., in Engler and Prantl, Natür. Pflanzenfam. 1^3: 125. 1895. *Jungermannia sulphurea* Lehm. et Lindenb., Lehm. Pug. Pl. **5**: 14. 1833. La Découverte, *Husnot 245,* listed by Husnot as *Omphalanthus sulphureus* Lehm. and Lindenb. (Y); sur les arbres, ravine Flore, bois supérieurs des Bains-Jaunes, Saut-de-Bouillante, etc., *Duss 6,* listed by Duss as *Lejeunea* (*Taxilejeunea*) *sulphurea* Spruce.

DISTRIBUTION: Tropical America.

TRACHYLEJEUNEA AMBIGUA (Lindenb. et Gott.) Steph., Spec. Hep. **5**: 305. 1913. *Lejeunea ambigua* Lindenb. et Gott., G. L. N. Syn. Hep. 764. 1847. Sur les bois pourrissant et sur l'écorce de différents vieux arbres, Matelyane, Sofaïa, *Duss 42, 97* (Y) (listed by Duss as *Lej.* (*Trachylejeunea*) *ambigua* Gott.).

DISTRIBUTION: Mexico.

TRACHYLEJEUNEA SPRUCEANA Steph., Hedwigia **35**: 138. 1896. Reported by Stephani without definite locality or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

FRULLANIACEAE

FRULLANIA ARIETINA Tayl., G. L. N. Syn. Hep. 413. 1845. Sur les arbres, Matouba, ravine Flore, *Duss 13,* listed by Duss.

DISTRIBUTION: Widely distributed in tropical America; also found in Florida.

FRULLANIA ATRATA (Sw.) Nees, G. L. N. Syn. Hep. 463. 1845. *Jungermannia atrata* Sw., Prodr. Fl. Ind. Occ. 144. 1788. Suspendue aux branches des arbres, *Husnot 221;* reported by Bescherelle from *Herb. Montagne;* also without definite locality or number, *L'Herminier;* sur les arbres, et arbrisseaux dans les montagnes, *Duss 226, 426.*

DISTRIBUTION: Mexico, Central and South America and the Antilles.

FRULLANIA BEYRICHIANA Lehm. et Lindenb., G. L. N. Syn. Hep. 460. 1845. *Jungermannia Beyrichiana* Lehm. et Lindenb., in Lehm. Pug. Pl. 5: 25. 1833. Sur les arbres, Savane-aux-Ananas, *Duss 217,* listed by Duss.

DISTRIBUTION: Tropical America.

FRULLANIA BRASILIENSIS Raddi, Mem. Soc. Ital. Mod. Fis. **19:** 36. 1823; **20:** *pl. 3. f. 2.* 1829. Sur les arbres, près de la source du Galion, *Husnot 222;* sur les arbres, environs des sources du Galion, *Duss 217b,* listed by Duss.

DISTRIBUTION: Widely distributed in the American tropics.

FRULLANIA CONNATA Lehm. et Lindenb., G. L. N. Syn. Hep. 783. 1847. Reported by Stephani without definite locality or name of collector, in Spec. Hep. **4:** 521.

DISTRIBUTION: Mexico.

FRULLANIA CONVOLUTA Lindenb. et Hampe, Linnaea **24:** 303. 1851. Reported by Stephani without definite locality, or name of collector, in Spec. Hep. **4:** 608.

DISTRIBUTION: Costa Rica, Panama.

FRULLANIA GUADALUPENSIS Gott., Steph. Spec. Hep. **4:** 496. 1911. Reported by Bescherelle without definite locality, from Herb. Mus. Paris, collected by *L'Herminier;* also reported by Stephani without definite locality, or name of collector; Massig Central, in *Sphagnum, Questel 1524* (P); St. Claude, Matouba, *Questel 1586* (P).

DISTRIBUTION: Known only from Guadeloupe.

FRULLANIA GYMNOTIS Mont., Ann. Sci. Nat. Bot. II. **19:** 257. 1843. Reported by Stephani, without definite locality, number or name of collector, in Spec. Hep. **4:** 635.

DISTRIBUTION: Dutch Guiana, Brazil.

FRULLANIA INVOLUTA Hampe, in Steph., Spec. Hep. **4:** 595. 1911. Reported by Bescherelle without definite locality or number, *L'Herminier;* sur un arbrisseau, sentier des sources du Galion à la Grande-Citerne, morne l'Échelle, Grande-Découverte, *Duss 315.*

DISTRIBUTION: Guiana, the Antilles.

FRULLANIA KUNZEI Lehm. et Lindenb., G. L. N. Syn. Hep. 449. 1846. *Jungermannia Kunzei* Lehm. et Lindenb., Lehm. Pug. Pl. **6:**

50. 1834. Sur les arbres, Matouba, habitation Planel, bords de la rivière Rouge, *Duss 209*, listed by Duss.

DISTRIBUTION: Southern United States, the Antilles, Brazil.

FRULLANIA MINIMA Steph., Spec. Hep. **4**: 532. 1911. Reported by Stephani without definite locality, or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

FRULLANIA PARASITICA Lehm. et Lindenb., Lehm. Pug. Pl. **7**: 11. 1838. Bois des Bains-Jaunes, *Duss 559* (Y), listed by Duss.

DISTRIBUTION: Brazil, Guiana, Dominica.

FRULLANIA RIOJANEIRENSIS (Raddi) Spruce, Trans. and Proc. Edinb. Bot. Soc. **15**: 23. 1884. *Frullanoides riojaneirensis* Raddi, Mem. Soc. Ital. Modena **19**: 37. 1823; **20**: *pl. 2. f. 4.* 1829. Sur les arbres vivants et pourris, morne de l'Échelle, *Duss 339a*, listed by Duss.

DISTRIBUTION: Widely distributed in tropical America; also found in Florida.

FRULLANIA SUBTILISSIMA (Mont. et Nees) Lindenb., G. L. N. Syn. Hept. 443. 1845. *Frullania atrata* var. *subtilissima* Mont. et Nees, in Mont., Ann. Sci. Nat. Bot. II. **14**: 333. 1840. Reported by Stephani without definite locality or name of collector in Spec. Hep. **4**: 631.

DISTRIBUTION: Brazil, Santo Domingo, St. Vincent.

FRULLANIA URBANII Steph., Spec. Hep. **4**: 527. 1911. Reported by Stephani without definite locality, or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

ANTHOCEROTACEAE

ANTHOCEROS CUCULLATUS Steph., Hedwigia **40**: 469. 1901. Sur la terre humide, le long des ruisseaux et dans les bois des Bains-Jaunes, *Duss 331*, *359*, listed by Duss.

DISTRIBUTION: Known only from Guadeloupe.

ANTHOCEROS FLEXIVALVIS Gott. et Nees, G. L. N. Syn. Hep. 586. 1847. Sur le sol humide, bois de l'As de Pique, *Duss 1074*, listed by Duss.

DISTRIBUTION: The Antilles.

ANTHOCEROS GOTTSCHEI Steph., Spec. Hep. **6**: 426. 1923. Reported by Stephani, without definite locality, *L'Herminier*.

DISTRIBUTION: Known only from Guadeloupe.

ANTHOCEROS LAEVIS L., Spec. Pl. 1139. 1753. Sur les rochers humides, *Husnot 203*, listed by Husnot; sur les rochers humides bordant le Bassin-Bleu dans le haut du morne Gommier, *Duss 361*, listed by Duss.

DISTRIBUTION: Widely distributed in Europe, Asia and North America; found also in Bermuda and Puerto Rico.

ANTHOCEROS PAPULOSUS Steph., Hedwigia **40**: 469. 1901. Sur la terre humide, bord d'un ruisseau dans l'intérieur des Bains-Jaunes, *Duss 144*, listed by Duss.

DISTRIBUTION: Martinique.

ASPIROMITUS GUADALUPENSIS (Gott.) Steph., Spec. Hep. **5**: 966. 1916. *Anthoceros guadalupensis* Gott., Steph., *l. c.* (as synonym). Reported by Stephani without definite locality or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

ASPIROMITUS LEIOSPORUS (Gott.) Steph., Spec. Hep. **5**: 962. 1916. *Anthoceros leiosporus* Gott., Steph., *l. c.* (as synonym). Sur les rochers de la rivière Noire et de la rivière Rouge, *Husnot 201*, as *Anthoceros leiosporus* Gott.; sur les rochers de la rivière Rouge, *Duss 363*, listed by Duss as *Anthoceros leiosporus* Gott.

DISTRIBUTION: Known only from Guadeloupe.

DENDROCEROS BRASILIENSIS Raddi, in G. L. N. Syn. Hep. 581. 1846. *Anthoceros brasiliensis* Raddi, Mem. Soc. Ital. Modena **18**: 344. 1818. Sommet de la découverte, *Husnot 204* (Y), listed by Husnot as *Dendroceros crispatus* Nees; sur les pierres, les vieux souches, les arbres et les bois pourrissants, bois des Bains-Jaunes, des Bains-Chaud, du Nez-Cassé, *Duss 199, 239, 305*, listed by Duss as *Dendroceros crispatus* Nees.

DISTRIBUTION: Tropical America.

DENDROCEROS CRISPUS (Sw.) Nees, G. L. N. Syn. Hep. 581. 1846. *Anthoceros crispus* Sw., Fl. Ind. Occ. III: 1884. 1806. Reported by Stephani, without definite locality, or name of collector in Spec. Hep. **5**: 1015.

DISTRIBUTION: Jamaica, Cuba, Puerto Rico, St. Vincent, Dominica.

MEGACEROS ALATIFRONS Steph., Spec. Hep. **5**: 947. 1916. *Anthoceros alatifrons* Steph., Hedwigia **40**: 469. 1901. Sur les rochers, la terre humide, les racines des fougères arborescentes, Matouba, Matelyane, Bains-Jaunes, etc., *Duss 219, 308, 332*, listed by Duss as *Anthoceros alatifrons* Steph.

DISTRIBUTION: Puerto Rico.

MEGACEROS SOLIDUS Steph., Spec. Hep. **5**: 950. 1916. Reported by Stephani, without definite locality, or name of collector.

DISTRIBUTION: Known only from Guadeloupe.

MEGACEROS VINCENTIANUS (Lehm. et Lindenb.) Campb., Ann. Bot. **21**: 472. *pl. 44. f. 19.* 1907. *Anthoceros vincentianus* Lehm. et Lindenb., Pug. pl. **6**: 16. 1834. Sur les troncs pourris, Vallée St. Louis, *Husnot 200*, listed by Husnot as *Anthoceros vincentianus* Lehm. and Lindenb.; sur les rochers humides, bois du Gommier, de la vallée St. Louis, du bord du Galion, etc., *Duss 364* (listed by Duss as *Anthoceros vincentianus* Lehm. and Lindenb.); also listed by Stephani in Spec. Hep. **5**: 948.

DISTRIBUTION: Cuba, Puerto Rico, St. Vincent, Martinique.

A NEW SPECIES OF DENDROCEROS FROM PUERTO RICO*

F. M. PAGÁN

Three species of *Dendroceros*, *D. crispus* (Sw.) Nees, *D. brasiliensis* Raddi, and *D. Breutelii* Nees, have been reported from the West Indies. *Dendroceros crispus* is the only member of the genus which has thus far been reported from Puerto Rico. The species described below is not only a distinct addition to the genus but represents the fourth member of *Dendroceros* to be added to the hepatic flora of the West Indies. The species is based on material collected by the writer at Km. 14.9 on the road through the Caribbean National Forest on the Luquillo Mountains, at an altitude of about 2000 feet.

The type specimen of the new species is preserved in the Herbarium of Yale University; duplicates of the type are in the Herbarium of the New York Botanical Garden and in the private collection of the writer at the University of Puerto Rico. The species may be characterized as follows:

DENDROCEROS **canaliculatus** sp. nov.

Planta monoica, dense caespitosa, pallide virens, terricola; fronde circa 2–3 cm. longa, repetito-furcata, lateque expansa, ramis saepe ascendentibus; costa latissima, valde canaliculata, media parte crassitudine 7–10 cellulas aequante, numquam bene distincta, subquadruplo latiore quam crassiore; alis tenerrimis, quam costa angustioribus, margine sinuatis vel lobulatis; lobulis integerrimis, leviter vel valde crispatis; cellulis alarum superis 20 x 27 μ, basalibus 30 x 50 μ; trigonis nullis; involucro ad 6–7 mm. longo, 0.4–0.5 mm. crasso, cuticula levi; capsula ca. 28 mm. longa, 0.16 mm. crassa, cellulis corticalibus trabeculate incrassatis; sporis parvis, diametro ca. 30 μ, unicellularibus, viridibus, verrucosis; elateribus 360 μ longis, 9 μ latis, monospiralibus.

The plants grow in compact mats and have a pale green color which becomes light olive green, or yellowish brown in drying. The thallus is 2–3 cm. long, strongly canaliculate throughout its entire length, repeatedly dichotomously branched (fig. 2) with some of the branches ascending. Intercalary branches are frequently present. The dorsal surface of the thallus is smooth, the ventral surface has numerous *Nostoc* colonies. In transverse section the thallus is 7–10 cells high in the middle (figs. 2 and 3). The inner cells are usually larger than the surface cells, but some of them appear as small in cross-section as

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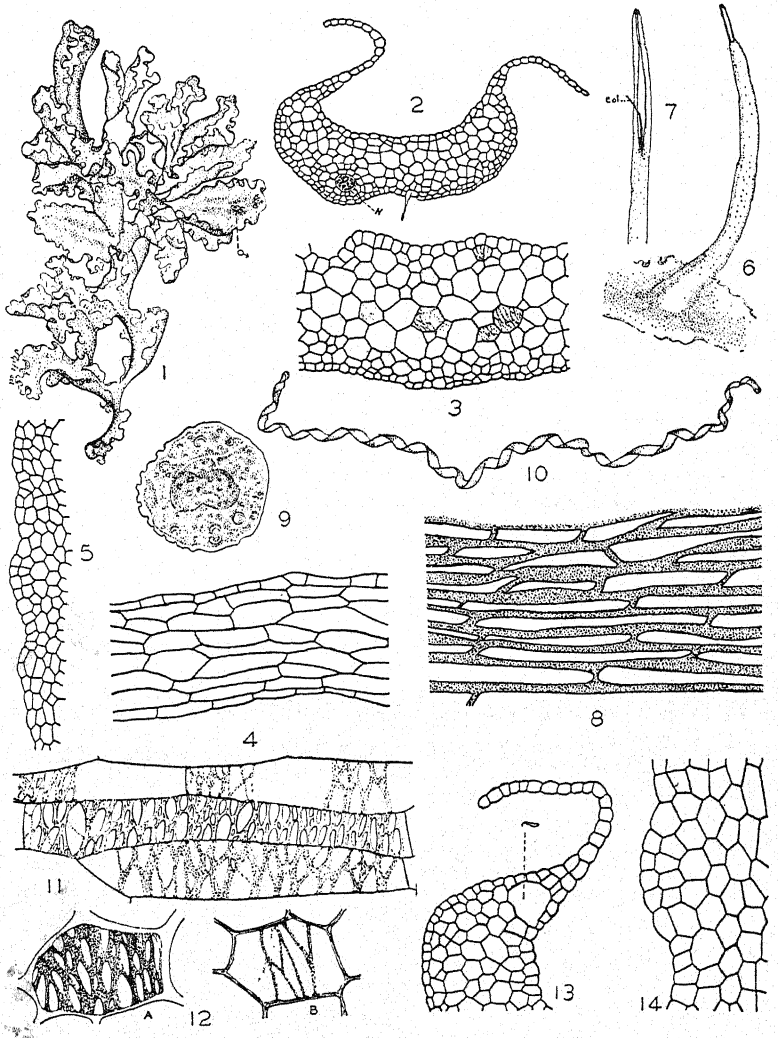
the surface cells. The walls of the inner cells are distinctly thickened, those of the outer or surface cells, particularly the radial walls, are thinner. In longitudinal section the inner cells are several times as long as wide (fig. 4). The end-walls which are almost as thick as the longitudinal walls, vary from transverse to strongly oblique, and quite frequently taper to points. Many of the inner cells have distinct thickening bands as shown in fig. 3. These bands arise on the inside face of the walls and form a loose or close reticulum which may cover the cell partly or entirely (figs. 11 and 12).

Cells with thickening bands or thickened pitted walls have been reported in several of the hepatics. Bolleter[1] and Cavers[2] have reported and illustrated such cells in *Conocephalum conicum*, Schiffner[3] in *Lunularia cruciata*, and more recently Voth[4] in *Marchantia polymorpha*. Cells of this type have been called "storage cells" because of the presence of starch in them and also because of their occurrence in the so-called storage region of such plants. So far as the writer knows there are no references to the occurrence of these cells in any of the other Anthocerotales. In *D. canaliculatus*, however, starch grains have not yet been observed. Moreover, these cells are present only in the midrib. The significance of these cells in *D. canaliculatus* is for the present, at least, not clear. However, while they do not seem to serve for the storage of carbohydrates, the general structure of the cells with their extremely thickened pitted walls and their occurrence only in the midrib seems to suggest they are better suited for conduction. In addition, perhaps these cells may be useful in lending mechanical support to the thallus, for although it is more or less prostrate there is clear evidence that many of the branches are ascending or almost erect in position.

The midrib, unlike most species of *Dendroceros*, is not sharply defined. It is about 0.8 mm. wide (often wider) and about 0.26 mm. thick in its median portion. It has no intercellular spaces except for the occasional presence of one or more large lacunae just below the point where the midrib passes into the lamina (fig. 13). The lamina is composed of but a single layer of cells in thickness. In well developed plants it is from 0.3–0.4 mm. wide, slightly to very strongly crispate. The margin varies from vaguely sinuate to irregularly lobed. The sinuses are usually broad but never very deep (fig. 5). The cells of the lamina are thin-walled throughout, without trigones or intercellular spaces (fig. 14). Marginal alar cells on the average measure 20 x 27 μ, the basal cells 30 x 50 μ.

Plants are monoicous. The archegonia and the antheridia develop in acropetal succession on the back of the thallus and never on special branches. The short-stalked antheridium is spherical or nearly so,

[1] Beih. Bot. Centralbl. 18[1]: 332. 1905.
[2] Ann. Bot. 18: 91. 1904.
[3] Engler and Prantl, Natur. Pflanzenfam. I[3]: 17. 1909.
[4] Bot. Gaz. 102: 201. 1940.



Figs. 1–14. DENDROCEROS CANALICULATUS Pagán. 1. Part of a plant, showing method of branching and a group of antheridia, dorsal view, 9. 2. Cross-section of a thallus, showing a colony of *Nostoc* (N), × 100. 3. Cross-section of the midrib, showing thickening bands in some of the cells, × 172. 4. Longitudinal section of the midrib, × 100. 5. Portion of the wings, showing lobing, × 172. 6. A nearly mature sporophyte, × 9. 7. Portion of the sporogonium, showing method of dehiscence and part of the columella (col.), × 18. 8. Cells from the outermost layer of the sporogonium, × 582. 9. A mature spore, × 970. 10. An elater, × 430. 11. Cells of the midrib in longitudinal section showing the thickening bands, × 430. 12 A and B. Cells of the midrib in cross-section showing thickening bands, × 970. 13. Portion of the cross-section of the thallus showing a lacuna (l), × 172. 14. Portion of the lamina, × 258.

and is about 160 μ in diameter. The mature sporophyte is about 28 mm. long and 0.16 mm. in diameter. The cells of the outermost layer of the sporogonium are elongate, measuring about 77 μ in length. Their lateral walls are strongly and uniformly thickened (fig. 8). Dehiscence of the sporogonium is along one suture (fig. 7). The involucre is 6–7 mm. long and 0.4–0.5 mm. in diameter, becoming narrower towards the apex and broader at the base (fig. 6). The outermost layer of cells of the involucre are thin-walled and smooth. The mouth of the involucre is lobed, with the lobes acute to subacute. The mature spores are relatively small, measuring on the average, 30 μ in maximum diameter (fig. 9). They are unicellular, yellowish-green in color and each with a large, lenticular, chloroplast centrally placed. In most cases observed the chloroplast was undergoing cleavage. The margin of the spores is hyaline, irregularly sinuate along one side, hence the margin appears as if with broad, flattened teeth. The surface sculpture of the spores consists of a few scattered ridges varying in size and shape, but most of them curved and simple, while the longer ridges are more or less straight and show a tendency to branch or anastomose. The convex surface of the spore has minute warts, more or less evenly distributed over the entire surface. The elaters are yellow, unispiral, blunt at both ends and about 360 μ in length by 9 μ in width at the middle (fig. 10).

Habitat: In thick mats on rocks covered by a layer of soil and decaying vegetable matter that is kept wet by the constant dripping of water from the rocks above.

Distribution: Known only from the Luquillo Mountains, Puerto Rico; Pagán no. 1902; Feb. 22, 1941: *the type.*

The distinguishing characteristics of this species are its strongly canaliculate thallus; its broad, poorly defined midrib; and its terrestrial habitat.

The present species is very distinct from all other West Indian species of *Dendroceros* by reason of the absence of trigones and intercellular spaces in the cells of the lamina. It also differs in the size and in the surface sculpture of the spores. According to Stephani[1] the spores of *D. brasiliensis, D. Breutellii,* and *D. crispus* measure 72 μ, 54 μ, and 50 μ respectively. The writer's measurement for these same species are: 80 μ, 46 μ, and 58 μ respectively, while in *D. canaliculatus* the spores are only 30 μ. The surface sculpture of the spores in *D. canaliculatus* consists of minute warts and ridges, while in the other West Indian species the spores are thickly granular-papillate. *D. canaliculatus* agrees with *D. brasiliensis* and *D. Breutelii* in their unicellular spores, but differs from these species in that the outermost layer of the involucre is smooth. In this respect *D. canaliculatus* agrees with *D. crispus* which also has a smooth involucre. In *D. canaliculatus* and *D. Breutelii* the outer cells of the capsule become much thickened at maturity. In both species the cells are elongated

[1] Spec. Hepat. 5: 1011 and 1015. 1917.

with the lateral walls uniformly thickened. On the average these cells measure 77 μ in *D. canaliculatus* and 65 μ in *D. Breutelii*. In *D. crispus* these cells are shorter, measuring 58 μ. Besides, the lateral walls remain thin while the thickening takes place only at the corners, thus giving the appearance of typical collenchyma-cells. In *D. brasiliensis*, on the other hand, the cells are much shorter, measuring 30 μ in length and with the lateral walls strongly nodulose.

The writer wishes to express his appreciation to Professors H. H. Bartlett of the University of Michigan for his assistance in preparing the Latin diagnosis and A. W. Evans of Yale University for his kindness in reading the manuscript and offering valuable criticisms and helpful suggestions, and to Miss Janet Gift, a senior student at Duke University, for drawing figures 1, 9 and 10. He also wishes to express his gratitude to all those who in one way or another have made this work possible.

THE MOSSES AND LIVERWORTS OF NANTUCKET*

MABEL A. RICE

An island flora intrigues a botanist. Perhaps the circumscribed area offers more hope to man's finite mind of rounding out lists to completeness than does the mainland. Then there is the alluring problem of the origin of plant species on a water-bound land. On Nantucket Island there is an added interest from recognition of the ancient forces which have shaped the island.

Glaciers of long ago have molded its surface into a diversity which invites a varied plant life. A line drawn lengthwise across the center of Nantucket Island marks the southern limit of the advance of the Pleistocene glaciers. There was more than one glacial advance, geologists tell us, and the last one pushed down before the ice blocks of an earlier ice age had fully melted (9). The result today is a picturesque moorland of kames and eskers rising in Saul's Hills to a one hundred foot elevation while in the hollows, where the persisting ice blocks of the earlier transgression prevented morainal deposits, small ponds, bogs, and wooded copses shelter rare plants. South of the irregular line of the foss, the depression where the southern edge of the ice mass stayed longest, an out-wash plain slopes gently to the ocean. This open, sandy plain is broken only by narrow ponds: remnants of the streams which formerly drained from the edge of the

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glacier. Ice, wind, and wave have shaped Nantucket. The result is a botanist's paradise.

Botanical records of Nantucket reach back to the early nineteenth century. William Oakes, who made a visit to the Island in 1829, is known as its first critical botanist (4). Mrs. Maria L. Owen published in 1888 a "Catalogue of plants growing without cultivation in the County of Nantucket" (7). She lists 470 species native to Nantucket and 116 introduced species. Eugene P. Bicknell visited the Island through a succession of years and the descriptive lists of Nantucket plants which he published from 1908 to 1916 are still authoritative (2). Except for a few ferns, Bicknell's list of 1136 species does not include cryptogams. Therefore algae, fungi, mosses and ferns offer rich fields of exploration on Nantucket today. The list of bryophytes given below is the first publication for this group on Nantucket.

To one who knows the wealth of mosses in mountain ravines of the mainland a low, wind-swept island may seem a poor place in which to search for mosses. What Nantucket lacks, however, in its number of moss species is made up by its wide-spread moss carpet. Moreover, mosses are valuable to a Nantucket botanist as ecological indicators. Their communities are so consistent in their members that, given the mosses, one can readily fill out the other typical members of a plant association.

Nantucket mosses may be grouped ecologically into those of the dry moors, those of the bogs, and those of the forests. Bogs and forests on Nantucket are for the most part merely stages in the ecological succession which began with the post-glacial lakes (8). One may find all stages, of such hydroseres among Saul's Hills, from ponds bordered by cat-tails, to cranberry bogs walled about by thick blueberry scrub, or to forests barricaded by giant growths of blueberry, inkberry, and poison ivy. Forests on Nantucket have evidently fought a losing fight against the sweep of ocean winds but these climax forests of the glacial ponds persist in their protected hollows as lineal descendants from that ancient coastal forest which is supposed to have extended, before the post-glacial subsidence, from the Carolinas to Newfoundland (4, 6). Thus the mosses of the third group, those of the climax woods, are especially interesting since one finds here the mainland forest-setting in miniature.

This woodland group is also hardest to reach. It is usually ringed about by a remnant of a swamp and by an almost impenetrable thicket

of tall shrubs: blueberry, poison sumac and poison ivy, azalea and bayberry. The change from this border growth to a moss-carpeted woodland is often so sudden as to seem an entrance into a magic room—a sleeping-beauty's chamber won by a struggle through a barrier which does not fall at a word.

In Ram Pasture red maples shade such a room. The barricade here is of azalea and blueberry, rising ten feet tall out of the brown bog water. The tips of *Sphagnum cuspidatum* Ehrh. show at the surface of the water and *Sphagnum palustre* L. cushions the bases of the shrubs. Hepatics add to the green mat with the delicate tracery of *Odontochisma prostratum* Trevis. or the tiny erect heads of gemmae of *Odontochisma denudatum* (Mart.) Dum. One comes suddenly to the space where the maples stand. These are more like gnarled apple trees for they fork into several branches only a foot or two from the ground. They are grey, ancient-looking trees. Their small leaves seem grey; their spreading branches are tufted with grey rosettes of *Usnea florida* (L.) Web.; their grey bark is arabesqued with the lichen *Parmelia* sp. intermixed with the dark green of the moss *Ulota crispa* (Hedw.) Brid. In the hollows among the sprawling, exposed tree roots *Sphagnum* still grows along with loosestrife and marsh fern but mosses of the damp woodlands are the dominants. The bases of the maple trunks are wrapped in green aprons of *Plagiothecium striatellum* (Brid.) Lindb. and the roots are covered with the close green velvet of *Dicranum flagellare* Hedw. or the thicker pile of *Dicranum scoparium* Hedw.

The "Hidden Forest" has a more mixed growth than this red maple stand. Maples, flowering dogwood, and holly trees are dominated by great beeches. These, like the maples, are dwarfed as to their trunks and their spreading branches sweep the ground. "The tops of the trees conforming to the height and contour of the surrounding slopes" (6) make the forest viewed from without seem merely a thicket of low scrub. Within, there is a true forest undergrowth. Partridge berry vine, American star flower, Jack-in-the-pulpit, hay-scented fern, spinulose wood fern, and crested wood fern remind one of the mainland. With them there is a true woodland moss carpet. The Dicranums are much in evidence; white cushions of *Leucobryum glaucum* (Hedw.) Schimp. dot the path; *Polytrichum commune* Hedw. or *Mnium hornum* Hedw. clothes the bank and rotting stumps are green with *Tetraphis pellucida* Hedw.

Pitcher-plant swamp shows an earlier stage of a hydrosere. White water lilies with short-petioled leaves rising from the muck are indicators of an earlier lake stage. Scattered red maple saplings foretell a later forest stage but the co-dominants of the present bog are *Sphagna* and the bog moss, *Aulacomnium palustre* (Web. & Mohr) Schwaegr. One sinks knee deep into these wet mosses unless one chooses for stepping places the hummocks around the bases of azalea or poison sumac. On these mounds, curiously enough, one finds the alpine *Polytrichum, P. juniperinum* v. *alpestre* Bry. Eur. In this fastness grow the bog orchids. *Arethusa* blooms with the pitcher plants; *Calopogon*, along with the white azaleas.

One may see, on the sandy shore of Sesachacha Pond, bog mosses just starting to compete with pond plants. *Sphagnum* and *Aulacomnium* grow as tiny isolated patches on the sand like a pattern of green stars. Near a trickle of water *Philonotis fontana* (Hedw.) Brid. is yellow-green while dark clumps of *Anthoceros laevis* L. make a complimentary harmony with *Drosera longifolia* L. Finally, where the abruptly rising bank is crowned by a thicket of *Azalea*, there is a hint of woodland conditions as one discovers *Plagiothecium sylvaticum* (Brid.) Bry. Eur. and *Polytrichum commune* Hedw. under the brush. This same brush is draped with dry strands of *Drepanocladus fluitans* (Hedw.) Warnst.—evidence of high water conditions of the early summer.

The sour gum forest at the east end of Polpis harbor, although it has probably a different ecological history from those already described, shows the same sharp limits to its woodland community. Polpis harbor seems the result of an ancient subsidence of the land. A long low ridge of land runs down to the water on the east and it is set with a row of tall trees. They are outstanding, not only because of a height unusual for Nantucket trees, but because of their flat-topped contours. The trunks are bare of branches until towards the top but are swathed in a green investment of poison ivy. The row of trees, as one approaches, resolves itself into three rows of sour gum trees which extend as tongue-like ridges into a stand of cat-tails.

It is a long walk to the sour gums. One starts from the Polpis road across a salt marsh. Cord grass and sea lavender are its cover and green algae take the place of mosses. Then one comes to a fresh water swamp. It is heavy going here. One sinks deep into the water-logged *Sphagnum* unless one steps with care from one cat-tail clump to the

next. *Sphagnum* does not mind being immersed but *Leptodictyum riparium* (Hedw.) Warnst. climbs up the cat-tail stems and so keeps its tips above water. Poison ivy also wreathes the bases of the cat-tails and seems almost a water plant. Finally, under the sour gums, one draws a breath of relief at stepping upon firmer ground—mossy ground still but not the yielding moss of a *Sphagnum* bog. The wood carpet is woven of *Sphagnum magellanicum* Brid., *Dicranum flagellare* Hedw., *Leucobryum glaucum* (Hedw.) Schimp., *Polytrichum commune* Hedw., *Mnium cuspidatum* Hedw. and, daintiest of all, the ferny moss, *Thuidium delicatulum* (Hedw.) Mitt. This carpet is set as thickly as in a wood of the mainland with *Anemone, Anemonella, Trientalis, Maianthemum* and ferns. Notwithstanding all the blooms it seems a dying forest—possibly a drowning forest. Poison ivy has entered to invest the tree trunks far above our heads. There are many skeleton trees. The underbrush is a tangle of dead branches whose bleached surface is encrusted and tufted with a wealth of lichens.

Mosses are much less in evidence over the dry moorland than in bog and forest but it is easy to read an almost human quality into their struggle as pioneer plants on the moorland. What *Sphagnum* is to the bog the dwarf hairy cap, *Polytrichum piliferum* Hedw., is to the moor. It is almost omnipresent. It is a true pioneer plant, partner with the crustose lichen, *Bacomyces roscus* Pers. Along the sand of a rutted road its half-buried stalks catch the eye. On the gravel bank it makes a pattern in the grey crust of *Bacomyces*. A day of rain flowing over the sand is enough to spread the spores of both these plants and the two can stand the extreme of summer dryness. The moss will shrivel but it will surprise one with a fresh greenness when a rainy day comes. *Polytrichum piliferum* Hedw. also grows in partnership with the Cladonias, covering the barer spots in alternation with clumps of the branching lichen until finally the lichen masses make too thick a cover. Then the dwarf *Polytrichum* gives place to the taller *Polytrichum commune* Hedw. Finally mosses are entirely supplanted by the characteristic moorland cover of *Cladonia* and *Hudsonia*.

One moss of the forests proves its adaptiveness by coming out upon the moors. Wherever sedge or grass is sparse the close green cover of *Dicranum flagellare* Hedw. may be found. In this dry habitat it is browner and its velvet nap is twisted into wisps but a rainy day will quickly smooth it out. Another velvet-carpet moss lives with *Dicranum flagellare* Hedw. under the sparse grass of the moorlands.

It is a red-letter day when one discovers that instead of tiny pebbles dotting the *Dicranum* one has found the little orange, globe-like capsules of *Pleuridium acuminatum* Lindb., the tiniest of the dry moss group.

Even the sea shore has its distinctive moss. On the dune sands, among Cladonias and scrubby junipers, mats of *Dicranum condensatum* Hedw. protect themselves against dryness by growing a felty mass quite an inch thick. Neither wind nor dryness holds any terrors for the half-buried communities of the dunes.

A scientist knows that Nature mocks at categories. Therefore I am not surprised to find myself at the end of this survey with a moss community which does not fit into any one of my three groups. The frequent fogs of Nantucket give moisture enough to enable mosses to invade the town and a group of half-domesticated mosses gives greenness here in unexpected places. *Ceratodon purpureus* (Hedw.) Brid. is on the moors and also in cracks of brick walks or on old shingles of cottages in the town. Hypnums clothe foundation stones. Burnt-over spots at the public dump are yellowed with the cord moss, *Funaria hygrometrica* Hedw. while stone heaps are decorated with the silvery green of *Bryum argenteum* Hedw.

LIST OF THE BRYOPHYTES OF NANTUCKET

HEPATICAE

1. ANTHOCEROS LAEVIS L. Hummock Pond. July 11, 1933. Coll. by W. H. Sheldon. Det. by M. Fulford.
2. BAZZANIA TRIANGULARIS Lindb. Abnecount's Island. July 6, 1940. Coll. by M. A. Rice. Det. by M. Fulford.
3. CALYPOGEIA TRICHOMANIS (L.) Corda. Spotsa Swamp. July 11, 1933. Coll. by W. H. Sheldon. Det. by M. Fulford.
4. CEPHALOZIA BICUSPIDATA (L.) Dum. Long Pond. July 29, 1934. Coll. by W. H. Sheldon. Det. by M. Fulford.
5. CEPHALOZIA CONNIVENS (Dicks.) Lindb. Pond near Saul's Hills. Aug. 10, 1934. Coll. by W. H. Sheldon. Det. by M. Fulford.
6. CEPHALOZIA MEDIA Lindb. Ram Pasture. Aug. 29, 1941. Coll. by M. A. Rice. Det. by M. Fulford.
7. FOSSOMBRONIA sp. Raddi. Little Mioxie Pond. Sept. 10, 1933. Coll. by W. H. Sheldon. Det. by M. Fulford.
8. GEOCALYX GRAVEOLENS (Schrad.) Nees. Pond near Saul's Hills. Aug. 10, 1934. Coll. by W. H. Sheldon. Det. by M. Fulford.
9. LOPHOCOLEA HETEROPHYLLA (Schrad.) Dum. Capaum Pond. Sept. 6, 1933. Coll. by W. H. Sheldon. Det. by M. Fulford.
10. LOPHOZIA PORPHYROLEUCA (Nees.) Schiffn. (c. gemmae). Ram

Pasture. Sept. 8, 1941. Coll. by M. A. Rice. Det. by M. Fulford.

11. MARCHANTIA POLYMORPHA L. Long Pond. Sept. 6, 1933. Coll. by W. H. Sheldon. Det. by M. Fulford.

12. MICROLEPIDOZIA SETACEA (Web.) Joerg. Hollywood. Aug. 23, 1940. Coll. by M. A. Rice. Det. by M. Fulford.

13. MICROLEPIDOZIA SYLVATICA (Evans) Joerg. Long Pond. Sept. 6, 1933. Coll. by W. H. Sheldon. Det. by M. Fulford.

14. MYLIA ANOMALA (Hook.) S. F. Gray. Swamp south of Sesachacha Pond. Aug. 5, 1934. Coll. by W. H. Sheldon. Det. by M. Fulford.

15. ODONTOCHISMA DENUDATUM (Mart.) Dum. Spotsa, July 1, 1933. Coll. by W. H. Sheldon. Det. by M. Fulford.

16. ODONTOCHISMA PROSTRATUM (Swartz) Trevis. Long Pond. July 2, 1934. Coll. by W. H. Sheldon. Det. by M. Fulford.

17. PALLAVICINIA LYELLII (Hook.) S. F. Gray. Sesachacha Pond. Sept. 8, 1933. Coll. by W. H. Sheldon. Det. M. Fulford.

18. PELLIA EPIPHYLLA (L.) Corda. Long Pond. July 29, 1934. Coll. by W. H. Sheldon. Det. by M. Fulford.

19. RICCARDIA MULTIFIDA (L.) S. F. Gray. Spotsa Swamp. Sept. 2, 1934. Coll. by W. H. Sheldon. Det. by M. Fulford.

20. SCAPANIA NEMOROSA (L.) Dum. Swamp south of Sesachacha Pond. Aug. 5, 1934. Coll. by W. H. Sheldon. Det. by M. Fulford.

MUSCI

1. ATRICHUM UNDULATUM (Hedw.) Beauv. Pocomo. Aug. 26, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

2. AULACOMNIUM PALUSTRE (Web. & Mohr) Schwaegr. Taupaushaw. Aug. 2, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

3. BRACHYTHECIUM ACUTUM (Mitt.) Sull. Grove Lane. July 16, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

4. BRACHYTHECIUM STARKEI. (Brid.) Br. & Sch. Shawkemo Spring. Sept. 4, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

5. BRYHNIA NOVAE-ANGLIAE (Sull. & Lesq.) Grout. Hollywood. Aug. 24, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

6. BRYUM ARGENTEUM Hedw. Nantucket Dump. July 15, 1940. Coll. by M. A. Rice Det. by A. J. Grout.

7. CALLIERGON CORDIFOLIUM (Hedw.) Kindb. Long Pond. July 9, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

8. CERATODON PURPUREUS (Hedw.) Brid. Commons. 1939. Coll. by M. A. Rice. Det. by A. J. Grout.

9. CIRRIPHYLLUM BOSCII (Schwaegr.) Grout. Coleman Sanctuary. June 23, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

10. CLIMACIUM KINDBERGII (R. & C.) Grout. Pocomo. June 20, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

11. DICHELYMA CAPILLACEUM (Hedw.) B. & S. Hollywood. Aug. 23, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

12. DICRANELLA HETEROMALLA V. ORTHOCARPA (Hedw.) Paris.

Sesachacha. Aug. 10, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

13. DICRANUM CONDENSATUM Hedw. Coskata. Aug. 9, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

14. DICRANUM FLAGELLARE Hedw. Ram Pasture. Sept. 10, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

15. DICRANUM SCOPARIUM Hedw. W. D. Blair's. Sept. 13, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

16. DREPANOCLADUS ADUNCUS V. POLYCARPUS (Bland.) Warnst. Ram Pasture. Sept. 12, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

17. DREPANOCLADUS FLUITANS (Hedw.) Warnst. Hollywood. July 11, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

18. DREPANOCLADUS FLUITANS V. FALCATUS (Br. & Sch.) Roth. Maxey's Shore. Sept. 5, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

19. DREPANOCLADUS FLUITANS f. GRACILIS (Boul.) Warnst. Squam. Aug. 15, 1939. Coll. by M. A. Rice. Det. by A. J. Grout.

20. FONTINALIS NOVAE-ANGLIAE Sull. Maxey's Pond. July 26, 1941. Coll. by M. A. Rice. Det. by W. H. Welch.

21. FUNARIA HYGROMETRICA Hedw. Sconset Dump. June 26, 1939. Coll. by M. A. Rice. Det. by A. J. Grout.

22. HELODIUM PALUDOSUM (Sull.) Aust. Long Pond, West Shore. July 11, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

23. HETEROPHYLLIUM HALDANIANUM (Grev.) Kindb. Thorn Lot. Aug. 24, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

24. HYPNUM CUPRESSIFORME Hedw. 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

25. HYPNUM REPTILE Mx. 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

26. LEPTOBRYUM PYRIFORME (Hedw.) Schimp. Shawkemo Spring. Sept. 4, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

27. LEPTODICTYUM RIPARIUM (Hedw.) Warnst. Long Pond. Aug. 7, 1934. Coll. by G. Wyatt. Det. by C. A. Weatherby.

28. LEPTODICTYUM RIPARIUM forma. Pocomo. June 20, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

29. LEPTODICTYUM RIPARIUM f. FLACCIDUM (L. & J.) Grout. 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

30. LEUCOBRYUM GLAUCUM (Hedw.) Schimp. Coskata. Aug. 9, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

31. MNIUM AFFINE V. RUGICUM (Laur.) Br. & Sch. Grove Lane. July 16, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

32. MNIUM CINCLIDIOIDES Hüb. Sesachacha. Aug. 8, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

33. MNIUM HORNUM Hedw. Hollywood. July 11, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

34. PHASCUM CUSPIDATUM Hedw. Thorn Lot. July 15, 1940. Coll. by W. H. Sheldon. Det. by A. J. Grout.

35. PHILONOTIS FONTANA Brid. Sesachacha. Aug. 5, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

36. PHYSCOMITRIUM TURBINATUM (Mx.) Brid. Shawkemo Spring. Sept. 4, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

37. PLAGIOTHECIUM STRIATELLUM (Brid.) Lindb. Abnecount's Island. July 6, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

38. PLAGIOTHECIUM SYLVATICUM (Brid.) Bry. Eur. 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

39. PLEURIDIUM ACUMINATUM Lindb. Thorn Lot. July 15, 1940. Coll. by W. H. Sheldon. Det. by A. J. Grout.

40. POGONATUM PENSILVANICUM (Hedw.) Paris. Hollywood. July 11, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

41. POHLIA NUTANS (Schreb.) Lindb. Spotsa Swamp. July 9, 1933. Coll. by W. H. Sheldon. Det. by J. F. Collins.

42. POLYTRICHUM COMMUNE Hedw. Coleman Sanctuary. June 27, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

43. POLYTRICHUM PILIFERUM Hedw. Commons. May 15, 1939. Coll. by M. A. Rice. Det. by A. J. Grout.

44. POLYTRICHUM JUNIPERINUM v. ALPESTRE B. S. G. Pitcher Plant Swamp. July 20, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

45. SPHAGNUM CUSPIDATUM Ehrh. Taupaushaw. Aug. 2, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

46. SPHAGNUM MAGELLANICUM Brid. Ram Pasture. Sept. 8, 1941. Coll. by M. A. Rice. Det. by I. Schnooberger.

47. SPHAGNUM PALUSTRE L. Madaquet. July 23, 1941. Coll. by M. A. Rice. Det. by I. Schnooberger.

48. SPHAGNUM RECURVUM Beauv. Taupaushaw. July 23, 1941. Coll. by M. A. Rice. Det. by I. Schnooberger.

49. SPHAGNUM RECURVUM var. TENUE H. Klinggr. Taupaushaw. July 23, 1941. Coll. by M. A. Rice. Det. by I. Schnooberger.

50. TETRAPHIS PELLUCIDA Hedw. Hidden Forest. Sept. 7, 1933. Coll. by G. Wyatt. Det. by J. F. Collins.

51. THELIA HIRTELLA (Hedw.) Sull. Eatfire Spring. June 28, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

52. THUIDIUM DELICATULUM (Hedw.) Mitt. Coleman Sanctuary. June 27, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

53. ULOTA CRISPA (Hedw.) Brid. Coskata. Aug. 9, 1940. Coll. by M. A. Rice. Det. by A. J. Grout.

THE NATURAL SCIENCE DEPARTMENT OF THE MARIA MITCHELL ASSOCIATION, NANTUCKET, MASSACHUSSETTS.

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NEW RECORDS OF SIERRA HEPATICAE

The California Sierra Club's Base Camp for 1941 was located on Garnet Lake in Madera Co., California, at an elevation of 9704 ft. In that locality John Thomas Howell, Assistant Curator of Botany at the California Academy of Sciences, adding materially to his previous Sierra collections, obtained two species and one variety of liverworts new for California. These, as determined by Dr. Lois Clark, were:

Anthelia julacea (L.) Dumort. (*Howell 585*), found on the east shore of Garnet Lake, and *Leiocolea obtusa* (Lindb.) Buch (*Howell 586*), growing near Badger Lake at 9750 ft. The new variety was *Marsupella sphacelata* (Gies.) Dumort. var. *erythrorhiza* Limpr. (*Howell 564*), which grew at the east base of Banner Peak, 10,000 ft. The latter plant "plushed" the ground in extensive areas and was of the richest brown color.

These alpine regions presented a great variety of hepatics in very abundant growth.—DOROTHY SUTLIFFE, California Academy of Sciences, San Francisco, California.

NOTE—Professor Frederick McAllister, of the University of Texas (Austin), wishes information concerning the whereabouts of collections, however small, of Texan bryophytes, whether named or unnamed, so that he may cite them in his comprehensive study now in progress.

Volume 45, Number 3, containing pages 49–72, was issued June 1, 1942.

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A LIST OF KENTUCKY MOSSES

M. FULFORD AND H. T. SHACKLETTE

The published records of Kentucky mosses are surprisingly few and incomplete when one considers the wide variety of geological formations and the diverse habitats within the State. There seem to be only two published lists. One of them, by Dr. Charles Wilkins Short[1] of Transylvania University, was issued as an addition to a catalogue of the flowering plants of Kentucky in 1837, and included thirty-one species and varieties, all of them identified by Sir William J. Hooker. The other list, by G. D. Smith[2] in 1927, reported twenty-nine species. In addition to these records there have been citations of Kentucky mosses in a number of floras, monographic treatments and vegetation studies.

The writers had planned a comprehensive and detailed survey of the mosses of Kentucky which would have required several years of collecting and study for completion but the war has made it necessary to abandon the project for the present. For this reason it seems pertinent to publish the results of our studies to date, with the intention of completing them at some future time .

The list combines the results of the large and numerous collections and studies made by the faculty and students of the Department of Botany of the University of Cincinnati over a period of years, primarily in the eastern half of the State, and the intensive work of Mr. Shacklette in the western half. In particular we wish to mention the extensive collections of Dr. E. Lucy Braun, mostly from eastern Kentucky; the unpublished study of the mosses of Kenton County

[1] Third supplementary catalogue of the plants of Kentucky. Transylv. Jour. Med. **10**: 435–440. 1837.

[2] The Mosses of Kentucky. Kentucky Acad. Sci Trans. **2**: 56–57. 1927.

contrasted with those of Whitley and McCreary Counties, by Kay Baur; and the taxonomic work of Thomas Cobbe.

We are also indebted to Dr. B. B. McInteer of the University of Kentucky for aid in collecting; to Dr. Winona Welch for the determination of the species of *Fontinalis;* to Dr. W. C. Steere for assistance with determinations; and to the Kentucky Academy of Science for a field grant to Mr. Shacklette.

The list contains 169 species and 14 varieties or forms. Although it includes approximately 800 collections it is far from complete but it does give an idea of the varied flora to be found here. The arrangement follows that of the "List of North American Mosses north of Mexico"[1]. Specimens in the Herbarium of the University of Cincinnati are designated (C), those in the private collection of Mr. Shacklette (S).—M. F.

TETRAPHIDACEAE

TETRAPHIS PELLUCIDA Hedw. Caldwell (S), Carter (C), Elliott (C), Lewis (C), Powell (CS), Whitley (C), and Wolfe (CS) counties.

POLYTRICHACEAE

ATRICHUM MACMILLANI (Holz.) Frye. Bath (S), Henderson (S), Letcher (S), McCreary (S), Marshall (S), Meade (S), Muhlenberg (S), Perry (S), Pike (S), and Union (S) counties.

ATRICHUM UNDULATUM (Hedw.) Beauv. Boone (C), Edmonson (S), Elliott (C), McCreary (C), Marshall (S), Meade (S), Perry (S), Pike (S), Powell (CS), Rowan (C), Whitley (C), and Wolfe (CS) counties.

POGONATUM PENSILVANICUM (Hedw.) Paris. Bath (S), Lewis (C), McCreary (S), Marshall (S), Pike (S), Powell (SC), and Wolfe (SC) counties.

POLYTRICHUM COMMUNE Hedw. Laurel (C), Letcher (CS), Pike (S), and Powell (CS) counties.

POLYTRICHUM JUNIPERINUM Hedw. Carter (C), Letcher (C), Pike (S), Powell (C), Union (S), and Wolfe (S) counties.

POLYTRICHUM OHIOENSE Ren. & Card. Bath (C), Boone (C), Carter (C), Elliott (C), Fleming (C), Lewis (C), McCreary (C), Muhlenberg (S), Perry (S), Pike (S), Powell (CS), Rowan (C), Russell (S), Whitley (C), and Wolfe (CS) counties.

POLYTRICHUM PILIFERUM Hedw. Powell (SC) County.

FISSIDENTACEAE

BRYOXIPHIUM NORVEGICUM (Brid.) Mitt. Caldwell (S), Carter (C), Elliott (C), Menifee (S), Powell (CS), and Wolfe (CS) counties.

FISSIDENS ADIANTOIDES Hedw. Carter (C) County.

[1] THE BRYOLOGIST 43: 117–132. 1940.

FISSIDENS BRYOIDES Hedw. Elliott (C) County.

FISSIDENS CRISTATUS Wils. Jessamine (S), Letcher (S), Powell (S), Union (S), and Whitley (C) counties.

FISSIDENS HYALINUS Hook. & Wils. Kenton (C) County.

FISSIDENS JULIANUS (Mont.) Schimp. Union (S) County.

FISSIDENS MINUTULUS Sull. Boone (C), Carter (C), and Whitley (C) counties.

FISSIDENS OBTUSIFOLIUS Wils. Whitley (C) County.

FISSIDENS OSMUNDIOIDES Hedw. Boone (C), Carter (C), McCreary (C), Powell (C), and Whitley (C) counties.

FISSIDENS SUBBASILARIS Hedw. Pike (S) County.

FISSIDENS TAXIFOLIUS Hedw. Boone (C), Carter (C), Henderson (S), Meade (S), and Powell (CS) counties.

FISSIDENS VIRIDULUS (Web. & Mohr) Wahlenb. var. INCURVUS (Starke) Mönkem. Carter (C), McCreary (C), and Whitley (C) counties.

DITRICHACEAE

CERATODON PURPUREUS (Hedw.) Brid. Carter (C), Fleming (C), Letcher (S), Menifee (S), Pike (S), and Union (S) counties.

DITRICHUM PALLIDUM (Hedw.) Hampe. Bath (C), Boone (C), Caldwell (S), Carter (C), Henderson (S), Kenton (C), Letcher (S), Lyon (S), McCreary (CS), Marshall (S), Perry (S), Pike (S), Powell (CS), Whitley (C), and Wolfe (S) counties.

DITRICHUM PUSILLUM (Hedw.) E. G. Britton. Carter (C) and Wolfe (C) counties.

DICRANACEAE

DICRANELLA HETEROMALLA (Hedw.) Schimp. McCreary (CS), Powell (CS), Union (S), and Wolfe (C) counties.

DICRANELLA HETEROMALLA var. ORTHOCARPA (Hedw.) Paris. Carter (C) and Rowan (C) counties.

DICRANELLA RUFESCENS (Smith) Schimp. Carter (C) and Wolfe (C) counties.

DICRANELLA VARIA (Hedw.) Schimp. Boone (C) County.

DICRANUM CONDENSATUM Hedw. Perry (S), Powell (C), and Whitley (C) counties.

DICRANUM FLAGELLARE Hedw. Elliott (C), Lewis (C), Powell (CS), Pulaski (C), Whitley (C) and Wolfe (CS) counties.

DICRANUM FULVUM Hook. Powell (C) and Whitley (C) counties.

DICRANUM FUSCESCENS Turn. Letcher (S) County.

DICRANUM SCOPARIUM Hedw. Bath (CS), Boone (C), Carter (C), Elliott (C), Fleming (C), Lewis (C), Lyon (S), McCreary (C), Perry (S), Pike (S), Powell (CS), Rowan (C), Union (S), Whitley (CS), and Wolfe (C) counties.

DICRANUM SPURIUM Hedw. Powell (CS) and Wolfe (S) counties.

DICRANUM VIRIDE (Sull. & Lesq.) Lindb. Elliott (C) County.

LEUCOBRYACEAE

LEUCOBRYUM ALBIDUM (Brid.) Lindb. Perry (S) and Wolfe (S) counties.

LEUCOBRYUM GLAUCUM (Hedw.) Schimp. Bath (C), Boone (C), Carter (C), Clark (C), Elliott (C), Fleming (C), Laurel (C), Letcher (S), Lewis (C), Lyon (S), McCreary (C), Perry (S), Pike (S), Powell (CS), Rowan (C), Russell (S), Whitley (C), and Wolfe (C) counties.

CALYMPERACEAE

SYRRHOPODON TEXANUS Sull. McCreary (C), Powell (S), and Whitley (C) counties.

BUXBAUMIACEAE

DIPHYSCIUM FOLIOSUM (Hedw.) Mohr. Letcher (C), Lewis (C), Perry (S), Powell (CS), and Whitley (C) counties.

POTTIACEAE

BARBULA CONVOLUTA Hedw. Powell (S) County.

BARBULA UNGUICULATA Hedw. Kenton (C) County.

DIDYMODON RECURVIROSTRIS (Hedw.) Jennings. Powell (S) County.

GYMNOSTOMUM CALCAREUM Nees & Hornsch. Elliott (C), Menifee (S), Powell (S), and Whitley (C) counties.

POTTIA TRUNCATA (Hedw.) Fuern. Henderson (S) County.

TORTELLA CAESPITOSA (Schwaegr.) Limpr. Boone (C), Carter (C), McCreary (C), Meade (S), Powell (C), Whitley (C), and Wolfe (C) counties.

TRICHOSTOMUM TENUIROSTRE (Hook. & Tayl.) Lindb. Powell (S) County.

WEISIA CONTROVERSA Hedw. Carter (C), Union (S), and Whitley (C) counties.

GRIMMIACEAE

GRIMMIA ALPICOLA Hedw. var. RIVULARIS (Brid.) Broth. Pike (S) County.

GRIMMIA APOCARPA Hedw. Boone (C), Carter (C), Fleming (C), Franklin (C), Rowan (C), and Woodford (S) counties.

GRIMMIA LAEVIGATA Brid. Letcher (C) County.

GRIMMIA OLNEYI Sull. Powell (C) and Wolfe (C) counties.

GRIMMIA PILIFERA Beauv. Whitley (C) County.

HEDWIGIA CILIATA Hedw. Boone (C), Breathitt (S), Carter (C), Fleming (C), Laurel (C), Lawrence (C), Letcher (C), Lewis (C), McCreary (C), Perry (S), Pike (S), Powell (CS), Rowan (C), Union (S), Whitley (CS), and Wolfe (S) counties.

PTYCHOMITRIUM INCURVUM (Muhlenb.) Sull. Laurel (C), McCreary (C), Union (S), and Whitley (C) counties.

RHACOMITRIUM HETEROSTICHUM (Hedw.) Brid. var. RAMULOSUM (Lindb.) Jones. McCreary (C) County.

FUNARIACEAE

APHANORHEGMA SERRATUM (Hook. & Wils.) Sull. Kenton (C) and Union (S) counties.

FUNARIA AMERICANA Lindb. Boone (C) County.

FUNARIA FLAVICANS Michx. Fleming (C), Powell (C), and Union (S) counties.

FUNARIA HYGROMETRICA Hedw. Boone (C), Grant (C), Pike (S), Powell (C), Whitley (C), and Wolfe (C) counties.

FUNARIA HYGROMETRICA var. CALVESCENS (Schwaegr.) Bry. Eur. Menifee (S) County.

PHYSCOMITRIUM TURBINATUM (Michx.) Brid. Boone (C), Campbell (C), Carter (C), Fleming (C), Fulton (S), Henderson (S), Perry (S), and Whitley (C) counties.

ORTHOTRICHACEAE

DRUMMONDIA PROREPENS (Hedw.) Jennings. Boone (C), Caldwell (S), Fleming (C), Harrison (C), Meade (S), Powell (S), Union (S), Whitley (C), and Wolfe (S) counties.

ORTHOTRICHUM ANOMALUM Hedw. McCreary (C) and Whitley (C) counties.

ORTHOTRICHUM OHIOENSE Sull. & Lesq. Boone (C), Henderson (S), McCreary (C), and Menifee (S) counties.

ORTHOTRICHUM PUMILUM Dicks. Union (S) and Whitley (C) counties.

ORTHOTRICHUM SORDIDUM Lesq. & James. Fleming (C) County.

ORTHOTRICHUM STELLATUM Brid. Boone (C) County.

ORTHOTRICHUM STRANGULATUM Schwaegr. Clark (S) County.

ULOTA AMERICANA (Beauv.) Limpr. Whitley (C) County.

ULOTA CRISPA (Hedw.) Brid. Pike (S), Whitley (C), and Wolfe (C) counties.

TIMMIACEAE

TIMMIA MEGAPOLITANA Hedw. f. CUCULLATA (Rich.) Sayre. Boone (C) County.

AULACOMNIACEAE

AULACOMNIUM HETEROSTICHUM (Hedw.) Bry. Eur. Caldwell (S), Carter (C), Clark (C), Elliott (C), Lewis (C), Letcher (S), McCreary (C), Marshall (S), Meade (S), Perry (S), Powell (CS), Pulaski (C), Russell (S), and Whitley (C) counties.

AULACOMNIUM PALUSTRE (Web. & Mohr) Schwaegr. Clark (C), Fleming (C), Letcher (S), Pike (S), and Whitley (C) counties.

BARTRAMIACEAE

BARTRAMIA POMIFORMIS Hedw. Carter (C), Elliott (C), McCreary (C), Marshall (S), Meade (S), Menifee (S), Pike (S), Powell (CS), Pulaski (C), Rowan (C), Russell (S), Union (S), Whitley (C), and Wolfe (S) counties.

PHILONOTIS CAPILLARIS Lindb. Powell (S) County.

PHILONOTIS FONTANA (Hedw.) Brid. Lewis (C) and Whitley (C) counties.

BRYACEAE

BRYUM ARGENTEUM Hedw. Campbell (C), Madison (C), and Wolfe (C) counties.

BRYUM ARGENTEUM var. LANATUM (Beauv.) Bry. Eur. Letcher (S) County.

BRYUM BIMUM Schreb. Harlan (S), Powell (C), and Russell (S) counties.

BRYUM CAESPITICIUM Hedw. Elliott (C) and Union (S) counties.

POHLIA NUTANS (Hedw.) Lindb. Lyon (S), Powell (S), Union (S), and Whitley (C) counties.

POHLIA WAHLENBERGII (Web. & Mohr) Andrews. Boone (C), Perry (S), Powell (S), and Union (S) counties.

RHODOBRYUM ROSEUM (Bry. Eur.) Limpr. Carter (C), Fayette (S), Franklin (C), Jessamine (S), Letcher (S), Lewis (C), McCreary (C), Menifee (S), Pike (S), Powell (C), and Wolfe (C) counties.

MNIACEAE

MNIUM AFFINE Bland. Jessamine (C), Letcher (S), McCreary (C), Marshall (S), Powell (CS), Union (S), Whitley (C), and Woodford (S) counties.

MNIUM AFFINE var. CILIARE (Grev.) C. Müll. Elliott (C), Kenton (C), McCreary (C), Pike (S), and Powell (C) counties.

MNIUM CUSPIDATUM Hedw. Boone (C), Carter (C), Clark (S), Elliott (C), Fleming (C), Franklin (C), Henderson (S), Letcher (C), Lyon (S), Powell (S), and Union (S) counties.

MNIUM HORNUM Hedw. Elliott (C), Morgan (C), Pike (S), Powell (C), Whitley (CS), and Wolfe (CS) counties.

MNIUM MEDIUM Bry. Eur. McCreary (C) County.

MNIUM ORTHORRHYNCHUM Brid. Elliott (C), Letcher (C), and Menifee (S) counties.

MNIUM PUNCTATUM Hedw. Elliott (C), Letcher (C), Lewis (C), McCreary (C), Powell (C), Union (S), Whitley (CS), and Wolfe (C) counties.

MNIUM PUNCTATUM var. ELATUM Schimp. Letcher (C) and Pike (S) counties.

MNIUM SPINULOSUM Bry. Eur. Carter (C) and Whitley (C) counties.

MNIUM STELLARE Hedw. Carter (C) and Powell (C) counties.

HYPNACEAE

AMBLYSTEGIUM COMPACTUM (C. Müll.) Aust. Boone (C) County.

AMBLYSTEGIUM JURATZKANUM Schimp. Fulton (S) County.

AMBLYSTEGIUM SERPENS (Hedw.) Bry. Eur. Boone (C), Franklin (C), Greenup (C), Powell (S), and Whitley (C) counties.

AMBLYSTEGIUM VARIUM (Hedw.) Lindb. Boone (C), Meade (S), Powell (CS), Union (S), Whitley (C), and Woodford (S) counties.

BRACHYTHECIUM OXYCLADON (Brid.) Jaeger & Sauerb. Boone (C), Franklin (C), and Jessamine (C) counties.

BRACHYTHECIUM RIVULARE Bry. Eur. Meade (S) County.

BRACHYTHECIUM RUTABULUM (Hedw.) Bry. Eur. Boone (C) County.

BRACHYTHECIUM RUTABULUM var. FLAVESCENS (Brid.) Bry. Eur. Boone (C), Carter (C), Lewis (C), and Jessamine (C) counties.

BRACHYTHECIUM SALEBROSUM (Web. & Mohr) Bry. Eur. Boone (C), McCreary (C), and Whitley (C) counties.

BRACHYTHECIUM VELUTINUM (Hedw.) Bry. Eur. Boone (C) County.

BROTHERELLA RECURVANS (Michx.) Fleisch. Carter (C), Clark (C), Elliott (C), Harlan (C), Pike (S), and Powell (S) counties.

BROTHERELLA TENUIROSTRIS (Schimp.) Broth. Whitley (C) County.

BRYHNIA GRAMINICOLOR (Brid.) Grout. Boone (C) and Carter (C) counties.

BRYHNIA NOVAE-ANGLIAE (Sull. & Lesq.) Grout. Powell (S) County.

CAMPYLIUM CHRYSOPHYLLUM (Brid.) Bryhn. Boone (C), Carter (C), Edmonson (CS), McCreary (C), Rowan (C), Whitley (C), and Woodford (S) counties.

CAMPYLIUM HISPIDULUM (Brid.) Mitt. Boone (C), Powell (CS), Rowan (C), and Whitley (C) counties.

CIRRIPHYLLUM BOSCII (Schwaegr.) Grout. Bath (C), Boone (C), Caldwell (S), Carter (C), Clark (C), Elliot (C), Greenup (C), Fleming (C), McCreary (C), Marshall (S), Meade (S), Perry (S), Powell (CS), Rowan (C), Union (S), Whitley (C), and Wolfe (CS) counties.

CLIMACIUM AMERICANUM Brid. Bath (C), Caldwell (S), Carter (C), Edmonson (S), Franklin (C), Letcher (C), Lewis (C), McCreary (C), Meade (S), Pike (S), Union (S), Wayne (C), Whitley (C), and Woodford (S) counties.

CLIMACIUM KINDBERGII (Ren. & Card.) Grout. Lewis (C) County.

ENTODON CLADORRHIZANS (Hedw.) C. Müll. Boone (C), Franklin (C), and Wolfe (C) counties.

ENTODON SEDUCTRIX (Hedw.) C. Müll. Bath (S), Boone (C), Caldwell (S), Carter (C), Fulton (S), Franklin (C), Henderson (S), Meade (S), Powell (S), and Union (S) counties.

EURHYNCHIUM HIANS (Hedw.) Jaeger & Sauerb. Boone (C), Fleming (C), and Perry (S) counties.

EURHYNCHIUM RIPARIOIDES (Hedw.) Richards. Jessamine (S), Letcher (C), Powell (S), and Wolfe (S) counties.

EURHYNCHIUM SERRULATUM (Hedw.) Kindb. Boone (C), Campbell (C), Elliott (C), Fleming (C), Henderson (S), McCreary (C), Powell (C), Whitley (C), and Wolfe (S) counties.

EURHYNCHIUM STRIGOSUM (Hoffm.) Bry. Eur. Boone (C) and Letcher (S) counties.

HOMALOTHECIELLA SUBCAPILLATA (Hedw.) Card. Carter (C), Elliott (C), Fleming (C), and Lewis (C) counties.

HOMOMALLIUM ADNATUM (Hedw.) Broth. Bath (S) and Boone (C) counties.

HYGROAMBLYSTEGIUM FLUVIATILE (Hedw.) Loeske. Boone (C), Franklin (C), McCreary (C), and Whitley (C) counties.

HYGROAMBLYSTEGIUM IRRIGUUM (Wils.) Loeske. Boone (C), Carter (C), Letcher (C), and Powell (C) counties.

HYLOCOMIUM BREVIROSTRE (Beauv.) Bry. Eur. Elliott (C) and Wolfe (C) counties.

HYPNUM CRISTA-CASTRENSIS Hedw. Wolfe (C) County.

HYPNUM CURVIFOLIUM Hedw. Bath (C), Boone (C), Caldwell (S), Carter (C), Casey (S), Edmonson (CS), Elliott (C), Fleming (C), Franklin (C), Jessamine (C), Laurel (C), Letcher (S), Lewis (C), McCreary (CS), Marshall (S), Meade (S), Perry (S), Powell (CS), Rowan (C), Russell (S), Union (S), Whitley (C), and Wolfe (CS) counties.

HYPNUM FERTILE Sendt. McCreary (C) County.

HYPNUM IMPONENS Hedw. Bell (C), Carter (C), Clark (C), Elliott (C), Fleming (C), Lewis (C), Perry (S), Pike (S), Powell (CS), and Wolfe (CS) counties.

HYPNUM MOLLUSCUM Hedw. Elliott (C), Fleming (C), McCreary (C), Rowan (C), and Wolfe (C) counties.

HYPNUM PATIENTIAE Lindb. Boone (C), Powell (S), and Union (S) counties.

LEPTODICTYUM RIPARIUM (Hedw.) Warnst. Boone (C), Edmonson (S), Union (S), Whitley (C), and Woodford (S) counties.

PLAGIOTHECIUM DENTICULATUM (Hedw.) Bry. Eur. Boone (C), Elliott (C), McCreary (C), and Whitley (C) counties.

PLAGIOTHECIUM DENTICULATUM f. PROPAGULIFERA Ruthe. Boone (C) County.

PLAGIOTHECIUM DEPLANATUM (Sull.) Grout. Boone (C), Elliott (C), Jessamine (C), Menifee (S), Whitley (C), and Woodford (S) counties.

PLAGIOTHECIUM GEOPHILUM (Aust.) Grout. Boone (C) and Meade (S) counties.

PLAGIOTHECIUM MICANS (Sw.) Paris var. FULVUM (Hook. & Wils.) Paris. McCreary (C) County.

PLATYGYRIUM REPENS (Brid.) Bry. Eur. Bath (S), Boone (C), Elliott (C), Lewis (C), McCreary (C), and Whitley (C) counties.

POROTRICHUM ALLEGHANIENSE (C. Müll.) Grout. Carter (C), Jessamine (C), McCreary (C), Powell (CS), Trimble (C), and Wolfe (C) counties.

PYLAISIA INTRICATA (Hedw.) Bry. Eur. Bath (S) County.

RHYTIDIUM RUGOSUM (Hedw.) Kindb. Carter (C) County.

SCIAROMIUM LESCURII (Sull.) Broth. McCreary (C), Powell (CS), and Whitley (C) counties.

SEMATOPHYLLUM ADNATUM (Michx.) E. G. Britton. McCreary (C) County.

SEMATOPHYLLUM CAROLINIANUM (C. Müll.) E. G. Britton. Elliott (C), McCreary (C), Perry (S), and Whitley (C) counties.

SEMATOPHYLLUM MARYLANDICUM (C. Müll.) E. G. Britton. Whitley (C) County.

LESKEACEAE

ANOMODON ATTENUATUS (Hedw.) Hüben. Boone (C), Carter (C), Elliott (C), Fleming (C), Franklin (C), Greenup (C), Jessamine (S), Letcher (C), Lewis (C), McCreary (C), Marshall (S), Meade (S), Rowan (C), Union (S), Whitley (C), and Woodford (S) counties.

ANOMODON MINOR (Beauv.) Lindb. Boone (C), Carter (C), Franklin (C), and Letcher (C) counties.

ANOMODON ROSTRATUS (Hedw.) Schimp. Boone (C), Carter (C), Elliott (C), Fleming (C), Franklin (C), Greenup (C), Laurel (C), Letcher (S), Lewis (C), McCreary (C), Meade (S), Powell (CS), Rowan (C), Union (S), Whitley (C), and Wolfe (C) counties.

HAPLOHYMENIUM TRISTE (Cesati) Kindb. Boone (C), Carter (C), Elliott (C), Franklin (C), McCreary (C), and Whitley (C) counties.

HELODIUM PALUDOSUM (Sull.) Aust. Edmonson (S) and Whitley (C) counties.

LESKEA GRACILESCENS Hedw. Boone (C) County.

LESKEA OBSCURA Hedw. Boone (C), Fulton (S), Gallatin (C), Henderson (S), Marshall (S), Union (S), and Whitley (C) counties.

LESKEA POLYCARPA Hedw. Boone (C) County.

MYURELLA CAREYANA Sull. Carter (C) and Powell (S) counties.

THELIA ASPRELLA Sull. Boone (C), Lewis (C), and Whitley (C) counties.

THELIA HIRTELLA (Hedw.) Sull. Bath (S), Boone (C), Carter (C), Elliott (C), Fleming (C), Jessamine (S), Lewis (C), McCreary (C), Powell (S), Rowan (C), and Whitley (C) counties.

THUIDIUM DELICATULUM (Hedw.) Mitt. Bath (C), Boone (C), Carter (C), Clark (C), Elliott (C), Fleming (C), Franklin (C), Letcher (S), Lewis (C), McCreary (CS), Pike (S), Powell (CS), Rowan (C), Union (S), Whitley (C), and Woodford (S) counties.

THUIDIUM PYGMAEUM Bry. Eur. Woodford (S) County.

THUIDIUM RECOGNITUM (Hedw.) Lindb. Jessamine (S) and Union (S) counties.

THUIDIUM SCITUM (Beauv.) Aust. McCreary (C) County.

THUIDIUM VIRGINIANUM (Brid.) Lindb. Fleming (C), Fulton (S), and Marshall (S) counties.

HOOKERIACEAE

HOOKERIA ACUTIFOLIA Hook. Caldwell (S), Laurel (C), Powell (CS), and Wolfe (CS) counties.

NECKERACEAE

NECKERA PENNATA Hedw. Harlan (C) County.

LEUCODONTACEAE

LEPTODON OHIOENSIS Sull. Boone (C), Elliott (C), Laurel (C), Whitley (C), and Wolfe (C) counties.

LEPTODON TRICHOMITRION (Hedw.) Mohr. Carter (C), Franklin (C), McCreary (C), Rowan (C), and Wolfe (C) counties.

LEPTODON TRICHOMITRION var. IMMERSUS (Sull. & Lesq.) Lesq. & James. Whitley (C) County.

LEUCODON BRACHYPUS Brid. Boone (C), Fayette (S), Pike (S), and Whitley (C) counties.

LEUCODON JULACEUS (Hedw.) Sull. Boone (C), Edmonson (S), Franklin (C), Harrison (C), Lewis (C), Marshall (S), Powell (C), Rowan (C), and Whitley (C) counties.

LEUCODON SCIUROIDES (Hedw.) Schwaegr. Fleming (C) County.

FABRONIACEAE

CLASMATODON PARVULUS (Hampe) Sull. Fulton (S) and Whitley (C) counties.

FABRONIA RAVENELII Sull. Bath (S) County.

SCHWETSCHKEOPSIS DENTICULATA (Sull.) Broth. Boone (C) and Whitley (C) counties.

FONTINALACEAE

FONTINALIS DISTICHA Hook. & Wils. Union (S) County.

FONTINALIS FILIFORMIS Sull. & Lesq. Austin, Musci Appalachiani No. 250, Lesquereux, Southern Kentucky.

FONTINALIS NOVAE-ANGLIAE Sull. Caldwell (S), Letcher (S), and Wolfe (CS) counties.

FONTINALIS NOVAE-ANGLIAE var. CYMBIFOLIA (Aust.) Welch. Whitley (C) County, also Welch No. 1086.

SPHAGNACEAE

SPHAGNUM COMPACTUM DC. McCreary (C) and Powell (C) counties.

SPAGNUM FUSCUM (Schimp.) H. Klinggr. Powell (C) County.

SPHAGNUM MAGELLANICUM Brid. Powell (C) and Whitley (C) counties.

SPHAGNUM PALUSTRE L. McCreary (C) County.

SPHAGNUM ROBUSTUM (Rüssow) Röll. Powell (C) County.

SPHAGNUM STRICTUM Sull. Fleming (C) County.

SPHAGNUM SUBSECUNDUM Nees. Wolfe (C) County.

SPHAGNUM TENERUM Sull. & Lesq. Powell (C) County.

UNIVERSITY OF CINCINNATI AND
U. S. ARMY, CAMP BARKELEY, TEXAS.

SOME MARCHANTIALES FROM MEXICO, COSTA RICA AND PANAMA

RUTH DOWELL SVIHLA

In Central America and Mexico many South American species of Hepaticae meet closely related North American ones. The paucity of publications on the species of this area makes it desirable that even small collections be reported. The following records from Mexico based on specimens collected by Dr. and Mrs. T. C. Frye in 1939, 1940 and 1941 add to those previously published (1); those from Panama and Costa Rica were collected during the summers of 1940 and 1941 by the author.

TARGIONIA HYPOPHYLLA L. MEXICO: Michoacán, Uruapán, National Park in the city (Frye and Frye 3050), Jan. 10, 1941. COSTA RICA: Mt. Irazú, Pacific side (Svihla 41456, with *Anthoceros* sp.), July 6, 1941.

Although of world-wide distribution, this seems to be the first published record of its occurrence in Costa Rica. It is known northward in San Salvador (3) and Mexico (1, 3, and others) and southward in Ecuador, Peru and Chile (9).

PLAGIOCHASMA RUPESTRE (Forst.) Steph. COSTA RICA: banks of Rio Torres between San José and Heredia (Svihla 41452), July 5, 1941; Rancho el Rodeo (Svihla 41506), July 18, 1941. PANAMA: Chiriquí Province, Boquete (Svihla 41404), Sept. 5, 1940; near Boquete on trail to Baja Mona (Svihla 40414), Sept. 9, 1940.

These are the first records from Central American countries; Evans (2) lists specimens from Mexico, Jamaica and South America.

PLAGIOCHASMA CRENULATUM Gottsche. MEXICO: San Luis Potosí Tamazunchale, on dirt of rock outcrop along river, 1 mile east of town [Frye and Frye 2977, with *Asterella echinella* (Gottsche) Underwood], Jan. 1, 1941.

This confirms the indication of a continuous distribution in Mexico as mentioned previously (1) for it adds a central locality record for this species which heretofore has been found in the northwestern (Sonora), southwestern (Chiapas) (2) and northeastern (Nuevo León) States (1).

ASTERELLA ECHINELLA (Gottsche) Underwood. MEXICO: San Luis Potosí, Tamazunchale, on dirt of rock outcrop along river, 1 miie east of town (Frye and Frye 2977, with *Plagiochasma crenulatum* Gottsche; 2978), Jan. 1, 1941.

This has been reported previously from Arkansas, Texas and the type locality, Vera Cruz in Mexico (4).

ASTERELLA LATERALIS M. A. Howe. PANAMA: Chiriquí Province, Boquete (Svihla 40429, 40432, 40434), Sept. 3, 1940.

These specimens resemble *A. lateralis* more closely than they do any other species although the spores are smaller and have no tinge of purple. This species is known from Mexico, and probably from Costa Rica and Ecuador (3). These records from Panama form a natural link in the distribution of the species.

DUMORTIERA HIRSUTA (Sw.) Nees. MEXICO: San Luis Potosí, Tamazunchale, about 27 km. southward (Frye and Frye 2991), Jan. 2, 1941; Michoacán, Uruapán, about 10 km. south at Zararacua Falls (Frye and Frye 3030, with *Marchantia polymorpha* L.), Jan. 9, 1941; National Park in the city (Frye and Frye 3041), Jan. 10, 1941. COSTA RICA: Mt. Irazú, Pacific side (Svihla 41458, in part), July 6, 1941. PANAMA: Chiriquí Province, Boquete (Svihla 40403), Sept. 5, 1940.

This adds another state (San Luis Potosí) in the distribution of the species in Mexico. It has been reported previously by Evans (6) from the Central American republics of Guatemala, Nicaragua and Panama. The above record from Costa Rica appears to be the first for that country.

PREISSIA QUADRATA (Scop.) Nees. PANAMA: Chiriquí Province, Boquete (Svihla 40447), Sept. 2, 1940.

Although previously reported on this continent "from Greenland to Mexico" (10), this appears to be the first record from south of Mexico.

MARCHANTIA POLYMORPHA L. MEXICO: Distrito Federal, Desierto, on wagon trail up a mountain about 5 km. from Desierto, altitude about 3650 meters, on ground under trees (Frye and Frye 2824), May 20, 1939; on rocks near waterline of streamlet (Frye and Frye 2831, in part), May 20, 1939; San Luis Potosí, Tamazunchale, about lat. 25° 15′ N., long. 97° 46′ W., on rock outcrop about 4 km. down river from town (Frye and Frye 2997), Jan. 1, 1941; Michoacán, Uruapán, about 10 km. south at Zararacua Falls (Frye and Frye 3030, in part), Jan. 9, 1941; on rocks in spray of Falls (Frye and Frye 3031), Jan. 9, 1941; Morelia, about lat. 19° 42′ N., long. 100° 56′ W., about 30 km. southeast along highway to Hidalgo where road to Chinapa branches off (Frye and Frye 3092), Jan. 13, 1941; Cerro Grande, altitude about 2700 meters (Frye and Frye 3123), Jan. 13, 1941; Morelos, Cuernavaca, about 5 km. north along highway to Mexico City in seepage from wall of an aqueduct, altitude about 1275 meters (Frye and Frye 3129), Jan. 16, 1941. COSTA RICA: Mt. Irazú, Atlantic side

(Svihla 41465, 41469, growing with *Polytrichum*), July 8, 1941; (Svihla 41475, mostly male plants), July 9, 1941.

These Mexican localities represent three new state records, San Luis Potosí, Michoacán and Morelos. It has been reported previously in Costa Rica from Volcán de Poaz (2).

MARCHANTIA CHENOPODA L. MEXICO: San Luis Potosí, Tamazunchale, on wet clay and rocks about 27 km. southward (Frye and Frye 2889, gemmae only), Jan. 2, 1941; Hidalgo, Chapulhuacán, about 5 km. southward on clay bank beside the road (Frye and Frye 2994), Jan. 2, 1941; Michoacán, Uruapán, about lat. 19° 17′ N., long. 101° 57′ W., about 10 km. south at Zararacua Falls on dirt and rocks (Frye and Frye 3028), Jan. 9, 1941. COSTA RICA: Mt. Irazú, Atlantic side (Svihla 41466, 41468, with *Anthoceros* sp.), July 8, 1941; (Svihla 41478, mostly female plants), July 9, 1941; San Isidoro Coronado (Svihla 41494, young female plants, 41497, 41501, 41505), July 13, 1941. PANAMA: Chiriquí Province, Boquete (Svihla 40418, 40433, 40439 young plants, 40445), Sept. 3, 1940.

This tropical American species has been previously reported from the states of Puebla and Vera Cruz in Mexico; from Guatemala; from Angostura, Alejuelita, Río Turialba, Cuesta de la Vieja, Juan Vinas and the vicinity of La Palma in Costa Rica; and from Darien in Panama (5).

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NOTES ON SOME HEPATICAE OF COSTA RICA

ARTHUR W. HAUPT

During the summer of 1940, the writer made a trip to Costa Rica primarily to collect liverworts, lycopods, and ferns for morphological investigation. Since the country has a flora extraordinarily rich in members of all three groups, much material was obtained. Widespread destruction of forests to make land available for cultivation, which has been going on near centers of population for many years, is continually being extended to other parts of the country. As automobile roads are built into the higher mountainous regions and large new areas are thus made accessible to the botanist, their magnificent forests soon become victims of the ax and machete. Patches of virgin forest still remain within easy reach of the larger towns, however, especially along rivers and streams. Soil exposed by the building of roads into the higher regions is soon overgrown by much vegetation, of which liverworts often form a considerable element.

Three or four trips a week were made during July and August in all directions from San José, the capital, situated on the Central Plateau at an elevation of 3,800 feet. Most of these trips were made by automobile and afoot to the surrounding mountains. Several days were also spent in the region around Turrialba, a town situated 40 miles east of San José and about 2,000 feet above sea level. Here the vegetation along the banks of the Reventazón River was found to be very rich.

An early account of Costa Rican Hepaticae is that of Stephani (1892), who studied collections made by Durand and Pittier. In it are listed 3 species of Marchantiales, 51 species of Jungermanniales (of which all but 5 are acrogynous), and two species of Anthocerotales. A later account, by Herzog (1939), deals with 108 species of acrogynous Jungermanniales collected by Standley, some in Honduras, but nearly all in Costa Rica. Additional collections made by Standley of certain other hepatics are cited by Evans in some of his numerous monographs.

Although a large number of species of Acrogynae were seen by the writer, most of them were found to be sterile. Having no value in investigations dealing with life histories, they were not collected. Only a few species were found to have sex organs, sporophytes, or both. Of these, only one species is not included in the lists of Stephani

and of Herzog. Of species belonging to other groups, however, a number apparently have not been previously reported as occurring in Costa Rica. Most of the determinations upon which the present list is based were made by the writer, except the species of *Riccardia, Pallavicinia, Plagiochila,* and *Trichocolea.* These were determined by the late Dr. F. M. Pagán, of the University of Puerto Rico, whose kind help is hereby acknowledged. All determinations were based on material preserved in liquid.

TARGIONIACEAE

TARGIONIA HYPOPHYLLA L. On moist humus banks along roadsides in the Escasú Mountains, southwest of Escasú, a village about 4 miles west of San José. When this region was visited on July 18, this species was the commonest liverwort seen. It was growing profusely, often in patches several inches square. Most of the plants were sterile. When another trip was made to the same mountains on August 7, this time in a direction almost directly south of the village, the species was again seen in abundance, mostly at elevations above 5,000 feet. Although still largely sterile, a number of fertile plants were collected, these mostly with young sporophytes.

The occurrence of this species in Costa Rica has apparently not been hitherto recorded. Evans (1923a) gives its distribution south of the United States as Mexico, Salvador, and South America. He states elsewhere (1923b) that it was "collected on a damp bank, in the winter of 1921–22, near the city of San Salvador, by Paul D. Standley . . . Not before reported from Central America."

MONOCLEACEAE

MONOCLEA GOTTSCHEI Lindb. Collected on July 25 and August 2 on the eastern slope of the Poás Volcano at an elevation of about 6,000 feet. Only plants with male receptacles were found, these growing on soil and fallen logs in a densely wooded ravine, often in association with *Dumortiera hirsuta* (Sw.) Nees. Both species occur in dark wet habitats. On August 9, both male and female plants were collected in the Tablazo Mountains, southwest of Cartago, at an altitude of about 5,500 feet. The female plants had sporophytes in various stages of development, some of them mature. This species, here also associated with *Dumortiera hirsuta,* was found in wet places in a small, densely wooded ravine.

According to Pagán (1939), this species has previously been found in Costa Rica. It is widely distributed throughout Central and South America, and also occurs in the West Indies.

REBOULIACEAE

PLAGIOCHASMA INTERMEDIUM Lindenb. & Gottsche. In San José, on the north bank of the Torres River between Bolívar Park and the Penitentiary, found on July 27 growing on a stone wall near a coffee-drying plant. Antheridia and archegonia, occurring on the same plants, were found in all developmental stages. Young and older sporophytes were present on the more advanced female receptacles. This species was again collected on August 7, near the top of the Escasú Mountains, south of Escasú, at an elevation of over 6,000 feet, where it grows on rocks in open places. These plants were larger than those collected in San José, and the female receptacles were more advanced in development, most of them having nearly ripe sporophytes. This species may be recognized by the presence of elaters with uniformly thickened walls.

This species seems not to have been previously reported from Costa Rica. Evans (1923a) gives its distribution as "Mexico and Guatemala; also in Japan." The writer can confirm its occurrence in Guatemala, having found it in abundance on September 7 and 23, 1940, on stone walls at Antigua, about 25 miles west of Guatemala City.

CRYPTOMITRIUM TENERUM (Hook.) Aust. Collected July 17 on moist shaded banks along a road through the Escasú Mountains, southwest of the village of Escasú; growing on humus in little pockets in the bank beneath other vegetation. The thin, pale green thalli bear numerous antheridia in a narrow median group lying posterior to the female receptacle and not, as stated by Evans (1923a), anterior to it. The female receptacles were young, only a few of them having embryos. Although this species was not seen again in Costa Rica, it was collected by the writer in Guatemala on September 13, 1940, growing on shaded banks in a moist ravine near Santa María de Jesús, between Quezaltenango and San Felipe. The archegonial receptacles were somewhat more advanced in development than those on the Costa Rican plants.

The occurrence of this species in both Costa Rica and Guatemala is hereby established. Evans (1923a) gives its distribution as "California and Mexico; probably also in Chili."

ASTERELLA LATERALIS M. A. Howe. Collected July 17 on moist shaded banks along a road through the mountains southwest of Escasú, a village about 4 miles west of San José. It was found growing on humus. Also found growing on red clay along a road through the mountains south of Aserrí, a village 5.5 miles south of San José; collected here on July 23. The occurrence of the male and female

receptacles on very short ventral branches and the absence of apical dichotomy make this species easily recognizable.

The distribution of *Asterella lateralis*, according to Evans (1923a), is "Mexico; probably Costa Rica; also in Ecuador." In his monograph Evans (1920) states that an early record by Stephani of the occurrence of *A. elegans* in Costa Rica, without definite locality, should probably be transferred to *A. lateralis*.

ASTERELLA PRINGLEI Underw. (?) A collection was made on August 7 of a small *Asterella*, possibly representing a new species, but resembling *A. Pringlei* in many ways and doubtfully assigned to it. A complete description is not possible because the female receptacles are immature, the oldest containing only advanced embryos. The plants were found growing on wet humus banks along a roadside near the top of the mountains lying south of the village of Escasú.

The thallus is up to 10 mm. long and 5 mm. wide. It is mostly once dichotomous, but occasionally branches by apical innovations. The air chambers are tall and narrow and without supplementary partitions. The male and female receptacles are borne generally on separate thalli, but sometimes on different branches of the same thallus. *A. Pringlei* is described as autoicous. The antheridia are borne in a narrow, elongated, median, dorsal receptacle with elevated pores leading to the antheridial chambers. The disk of the female receptacle, on the immature specimens studied, is hemispherical, not over 3 mm. in diameter, covered with low tubercles, and without evident lobes. In *A. Pringlei* the disk is 3–4 mm. wide and with mostly 4 short but distinct lobes.

Evans (1923a) states that *Asterella Pringlei* has been found only in central Mexico. In his monograph (1920) he cites only two stations, one near Guadalajara and the other near Orizaba.

MARCHANTIACEAE

DUMORTIERA HIRSUTA (Sw.) Nees. This species was found August 2 on the eastern slope of the Poás Volcano at about 6,000 feet altitude. Only a few plants were seen, all with young receptacles. Another collection was made on August 9 near the summit of the Tablazo Mountains, southwest of Cartago, at an elevation of about 5,500 feet. Both antheridial and archegonial plants were found, some of the female receptacles having well-developed sporophytes. In both localities the plants were growing in dark wet places in a small wooded ravine and in association with *Monoclea Gottschei* Lindb.

This species is widely distributed throughout tropical regions. It also occurs in parts of western and southern Europe and the eastern United States. Its occurrence in Costa Rica is noted in Stephani's (1892) list.

MARCHANTIA CHENOPODA L. This was the commonest liverwort seen in Costa Rica, where it is apparently widely distributed. At higher altitudes the plants are considerably larger than at lower altitudes, a feature previously noted by Miss McNaught (1929), who studied material collected by Professor George S. Bryan in Peru. She remarks that plants growing at an elevation of 10,000 feet are about twice as large as those collected at 2,000 feet. On July 18 the writer found this species abundant in the mountains southwest of Escasú, at elevations of 5,000 to 6,000 feet. It grows along roadsides, mainly on moist humus banks. The antheridial plants appeared to be older and more numerous than the archegonial plants. This liverwort was also found in abundance in the mountains south of the village of Aserrí, visited on July 23. It was also seen at various times and in several places in the immediate vicinity of San José, approximately 3,800 feet above sea level. At an elevation of about 6,000 feet, on the eastern slope of the Poás Volcano, plants were collected on July 25 that were larger and older than any previously seen. The antheridial and archegonial plants were equally numerous.

According to Evans (1923a), *Marchantia chenopoda* is found from "Mexico to Panama; West Indies; also in South America." Stephani (1892) records collections in Costa Rica made by Pittier from the vicinity of San José and La Palma. Evans (1917) records additional stations at Alajuelita, Río Turrialba, Juan Viñas, etc.

MARCHANTIA POLYMORPHA L. This species was seen only once, on August 2, growing on a vertical rocky cliff under a waterfall on the western slope of the Barba Volcano at about 4,500 feet elevation. The thalli and receptacles were very large, usually attaining and often somewhat exceeding the maximum size that Evans (1923a) gives for the species. In some specimens the stalk of the female receptacle measured almost 10 cm. in length. Many of the female receptacles had mature sporophytes.

This well-known species, very common and widespread throughout North America, extends south in less abundance through Mexico, Central America, and the West Indies into South America. The only previous record of its occurrence in Costa Rica is Stephani's (1892) citation of a collection by Pittier at "Potrero del Alto, Volcán de Poás."

ANEURACEAE

RICCARDIA PINGUIS (L.) S. F. Gray. Collected on August 22 in a dense forest along the east bank of the Reventazón River near Las Ánimas, a small station on the railway about 3 miles east of the town of Turrialba, at an elevation of about 1,800 feet. The plants were growing in damp places on fallen tree trunks. The thalli were unusually large, up to 3 cm. or more in length and 5 to 7 mm. in width. They bore antheridia and archegonia, as well as both young and mature sporophytes.

This species is of widespread occurrence in Europe, Asia, North America, and South America. There seems to be no record of its having been previously collected in Costa Rica.

RICCARDIA ANDINA (Spruce) Spreng. Collected on August 9 in the Tablazo Mountains, southwest of Cartago, at an altitude of about 5,500 feet. This is a small species that was growing vigorously in densely crowded patches on the rocky sides of a small ravine and on fallen logs, where it was confined to dark damp places. The plants bore sex organs and sporophytes. Collected again on August 25 on a trail leading to the crater of the Poás Volcano; elevation about 7,000 feet. Here it was growing in mats on moist soil on the vertical sides of a narrow ditch.

Stephani (1900–1924) gives the distribution of this species as the eastern Andes. He also mentions its occurrence in the vicinity of Cobán, Guatemala. It seems not to have been collected elsewhere in Central America.

DILAENACEAE

SYMPHYOGYNA BRASILIENSIS Nees. This species was first found on July 31 about a mile east of Las Nubes, on the western slope of the Irazú Volcano, and at an elevation of about 6,000 feet. Las Nubes is a small village lying about 9 miles northeast of San José. The plants were growing, with mosses and other liverworts, on a moist humus bank along a roadside. Most of the plants were young, but a few of the female plants bore well-developed sporophytes. On August 2 this species was collected near Vara Blanca, on the east slope of the Poás Volcano, and at an altitude of about 5,300 feet. Here the plants were found in abundance in a wet forest, growing in shade on rich humus, often with *S. Brongniartii* Mont. They were much more vigorous than the specimens found at Las Nubes. Some of the plants bore mature antheridia, others sporophytes.

A third collection was made on August 9 in the Tablazo Mountains, southwest of Cartago and close to the Pan-American Highway. The plants, growing in a moist shaded ravine, were abundant and vigorous.

Another trip was made to Vara Blanca on August 25 where, in a habitat near the one visited on August 2, many plants were collected from rich soil on the side of a densely wooded ravine. Although some mature sporophytes were found, most of the thalli bore antheridia or archegonia.

According to Evans (1927), *Symphyogyna brasiliensis* was collected in March, 1924, by Paul C. Standley at La Hondura and at Las Nubes, both in the Province of San José; in February, 1926, at Viento Fresco, Province of Alajuela, and at Yerba Buena, Province of Heredia. It is a species widely distributed in the American tropics, ranging from Mexico to Bolivia and Brazil.

SYMPHYOGYNA BRONGNIARTII Mont. Found growing luxuriantly in a wet ravine on very rich soil, in shade, near Vara Blanca, on the eastern slope of the Poás Volcano, and at an elevation of about 5,300 feet; August 2. The plants were mostly archegonial. Also found, on the same day, in a more open situation where many trees had been cut down. Here the plants were smaller, but many were antheridial and many bore sporophytes. On August 9 this species was collected in the Tablazo Mountains, southwest of Cartago, where it was also growing luxuriantly.

This species, according to Evans (1925), occurs in Guatemala, Costa Rica, the West Indies, and South America. He lists two collections from Costa Rica, as follows: Buena Vista, road to San Carlos Valley, Cook and Doyle, 1903; Tuccurique, Rowlee and Stork, 1920. Evans (1927), in a later paper, lists a collection from Cerro de la Carpintera, Province of Cartago, Standley, 1924.

PALLAVICINIA LYELLII (Hook.) S. F. Gray. This widely distributed species, especially prevalent in tropical regions, was found in a single collection mixed with specimens of *Symphyogyna brasiliensis* Nees, the thalli of the two being somewhat similar. It was obtained on August 2 on the Poás Volcano, near Vara Blanca, where it was growing on rich soil in a wet forest. Only a few archegonial plants were found.

PALLAVICINIA WALLISII J. and Steph. Found at only a single place, on August 25, on vertical sides of a narrow ditch along a trail leading to the crater of the Poás Volcano; elevation about 7,000 feet. Most of the plants bore sporophytes.

This is a species of the northern countries of South America. There is apparently no record of its occurrence in Costa Rica.

CODONIACEAE

FOSSOMBRONIA BRASILIENSIS Steph. First seen on July 18 at an elevation of approximately 4,300 feet in the mountains about one-half

mile southwest of the village of Escasú, situated four miles west of San José. Here it was growing on a moist humus bank along a roadside. The plants were producing abundant sex organs and a smaller number of young sporophytes. On August 11 this species was again collected in a similar habitat between the towns of Grecia and Naranjo, at an elevation of about 3,700 feet. The plants bore antheridia and archegonia in large numbers, but few sporophytes.

This widely distributed species ranges from southern New England to Brazil. No record has been seen of its occurrence in Costa Rica.

PLAGIOCHILACEAE

PLAGIOCHILA CRISTATA (Sw.) Dum. One large clump was found growing on a tree stump in a dense forest in the Tablazo Mountains near the Pan-American Highway; altitude about 5,500 feet. Collected on August 4. The plants were all antheridial.

According to Herzog (1939), this species has been collected by Standley in Costa Rica at the following stations: Cerros de Zurqui, Province of Heredia; Zurqui, Province of San José; Cerro de las Caricias, Province of Heredia.

PLAGIOCHILA HYPNOIDES Lindenb. Collected on tree trunks in a dense forest along a stream on the Hacienda Aragón, Turrialba, on August 21; elevation about 2,000 feet. The material had sex organs and sporophytes.

This is a common species in tropical America. Herzog (1939) lists two stations in Costa Rica, where it was collected by Standley: Hamburg Finca, below Cairo, Province of Limón; Finca Montecristo, Reventazón River.

PTILIDIACEAE

TRICHOCOLEA CRISTACASTRENSIS (Spr.) Steph. A single collection was made of plants, all archegonial, growing on a tree trunk in the Tablazo Mountains near the Pan-American Highway; elevation about 5,500 feet. The collection was made on August 9.

This species is not given either in the list of Stephani (1892) or of Herzog (1939). Apparently it has not been previously collected in Costa Rica. Stephani lists only *T. tomentella* Nees.

ANTHOCEROTACEAE

ANTHOCEROS PULCHERRIMUS Steph. Very abundant on wet vertical banks along the roadside about a mile east of Las Nubes, a village situated 9 miles northeast of San José; elevation about 6,000

feet. Collected on July 31. The plants were in all stages of development, the younger ones forming rosettes 1.5 to 3 inches in diameter. This species was also found on August 11 on a moist humus bank along the highway between Grecia and Naranjo at an elevation of approximately 3,700 feet. Here all the plants were young.

The distribution of this species, originally described by Stephani (1892) as *Aspiromitus pulcherrimus*, is stated by him to be merely "Costa Rica," no definite locality being mentioned.

MEGACEROS CRISTOSPORUS Steph. (?) Found on rich soil in a wet shady ravine near Vara Blanca, lying on the eastern slope of the Poás Volcano, at an altitude of about 5,300 feet. Collected on August 2. The plants were growing in association with *Symphyogyna brasiliensis* Nees and *S. Brongniartii* Mont. This species was again found, in a similar habitat, in the Tablazo Mountains, southwest of Cartago, on August 9.

In both collections the absence of mature sporophytes makes accurate determination of the species impossible. The characters of the thallus and of the young sporophyte, however, are similar to those of *M. cristosporus* as given by Stephani (1892, 1900–1924). This is the only species previously collected from Costa Rica. It was found by Pittier on damp branches and tree trunks in the forests of La Palma, elevation about 5,000 feet, on the Barba Volcano.

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NOTES ON THE GENUS RICCIA IN NEW MEXICO

ELBERT L. LITTLE, JR.[1]

Only two species of *Riccia* are included in the late Brother Arsène's[2] article on the liverworts of New Mexico, though *Riccia* is the largest liverwort genus in number of species in southwestern United States. Three additional species of *Riccia* in New Mexico are recorded here.

Brother Arsène reported *Riccia Frostii* Aust., collected in the vicinity of Ute Park, Colfax County, northern New Mexico, by Paul C. Standley. However, in his own thorough collecting around Las Vegas and Santa Fe in the northern part of the State, Brother Arsène found only a single plant of *Riccia, R. membranacea* Gottsche & Lindenb., at Hermit's Peak, San Miguel County. At the time of his death in 1938, Brother Arsène was preparing a supplement of additions to his list of New Mexico liverworts, but I found no specimens of *Riccia* among the specimens he arranged for distribution. I[3] reported a second record of *Riccia Frostii* Aust., from along Rio Grande near Las Cruces, Dona Ana County, southern New Mexico.

RICCIA CRYSTALLINA L. Growing in mud in spring at bottom of cliff, altitude 4,400 feet, 20 miles southwest of Carlsbad, Eddy County, southern New Mexico, April 10, 1924, *Dana W. Lee 101* (United States National Herbarium).

RICCIA AUSTINI Steph. Seven miles southeast of Mayhill, elevation 7,000 feet, Otero County, southern New Mexico, Nov. 26, 1938, *Little 5271;* same locality, Sept. 21, 1940, *Little 5272.*

This species is commonly represented on bare, shallow soil in openings at an experimental plot in a piñon-juniper woodland. The perennial thalli grow on soil where the limestone bedrock is only a few inches from the surface and grasses are absent.

RICCIA SOROCARPA Bisch. Seven miles southeast of Mayhill, elevation 7,000 feet, Otero County, southern New Mexico, Sept. 21, 1940, *Little 5273;* same locality, Sept. 17, 1941, *Little 5275;* Glorieta Mesa, elevation 7,500 feet, 15 miles south of Pecos, San Miguel County, northern New Mexico, Sept. 13, 1941, *Little 5274.*

This species is a rare summer annual on bare soil of grassy openings at two experimental plots in piñon-juniper woodlands, including the

[1] Associate forest ecologist, Southwestern Forest and Range Experiment Station, which is maintained by the Forest Service, United States Department of Agriculture, for the States of Arizona, New Mexico, and west Texas, with headquarters at Tucson, Arizona.

[2] Arsène, G. Hépatiques du Nouveau-Mexique (U. S. A.) déterminées par Miss Caroline Coventry Haynes. Ann. Crypt. Exot. 6: 150–160. 1933.

[3] Little, Elbert L., Jr. Bryophytes of the Jornada Experimental Range, New Mexico. THE BRYOLOGIST 40: 81–83. 1937.

locality where *R. Austini* was discovered. The plants grow in the rainy period of late summer, when the soil surface is moist. As soon as the soil becomes dry, the thalli fold together and become almost invisible.

My specimens of *Riccia Austini* and *R. sorocarpa* from New Mexico have been deposited in the United States National Herbarium, Herbarium of the New York Botanical Garden, and Hepatic Herbarium of the Sullivant Moss Society.

There is an early collection of another species, *Riccia fluitans* L., "New Mexico," *Charles Wright 908* (Herbarium of the Missouri Botanical Garden). This specimen of about 90 years ago, like many others of Wright, may not have been collected within the present boundaries of New Mexico, however, and should not be considered as a record for this state. It is to be expected that a few more species of *Riccia*, including *R. fluitans*, which is known from all the bordering States, will be found later within New Mexico.

LIVERWORTS AT RAINBOW BRIDGE NATIONAL MONUMENT, UTAH

ELBERT L. LITTLE, JR.[1]

A note on the single species of liverworts found at Rainbow Bridge National Monument, Utah, will emphasize the extremely sparse liverwort flora of this poorly accessible area. Rainbow Bridge, the largest natural bridge in the world, is located in Bridge Canyon, about six miles southeast of the Colorado River in San Juan County, southern Utah, and only about five miles north of the Arizona border. As it is so far from highways, only about three thousand persons have visited it since its discovery in 1909. It is usually reached from the end of a poor road by a 14-mile trail from Rainbow Lodge across the Arizona line, but has been visited from boat trips down the Colorado River.

On July 24 to 28, 1940, I made a trip on foot from Rainbow Lodge to Rainbow Bridge and the Colorado River and return, and from Rainbow Lodge to the summit of Navajo Mountain and return, a distance of about 60 miles altogether. From the Colorado River,

[1] Associate forest ecologist, Southwestern Forest and Range Experiment Station, which is maintained by the Forest Service, United States Department of Agriculture, for the States of Arizona, New Mexico, and west Texas, with headquarters at Tucson, Arizona.

elevation about 3,400 feet above sea level, to Navajo Mountain, elevation 10,416 feet, five zones of vegetation, from semidesert to spruce-fir subalpine forest are represented. Collecting only liverworts, I hoped to get specimens of several species but returned with specimens of only the common and well-known species, *Marchantia polymorpha* L.

Marchantia polymorpha L. is rare in Bridge Canyon, where it was found in the semidesert zone in a few places from two miles south of Rainbow Bridge to about five miles northwest of the bridge near the Colorado River. The thalli bearing gemmae cups but no sex organs form mats at the bases of continually moist, shaded, usually north-facing, sandstone canyon walls within two to three feet of running water. This is the typical habitat of the species in the semiarid Southwest, almost always within a few feet of permanent streams or seepage. No liverworts were found at springs along the trail, but liverworts seldom occur at springs in the semidesert zone in the Southwest.

An unsuccessful search for *Targionia hypophylla* L. was made at bases of drier sandstone walls. This species is common in similar habitats along the Colorado River at Grand Canyon National Park, Arizona, and at various other Arizona localities in the semidesert zone.

No liverworts were found on the ascent of the south side of Navajo Mountain, an isolated peak along the Utah-Arizona border. Fragments of sterile thalli which may have been liverworts were collected in moist soil at Pine Tree Spring at the lower limit of the ponderosa pine forest zone here. Perhaps a few liverworts will be discovered later on the almost inaccessible north side of the mountain. Extreme aridity probably is an important factor causing liverworts to be so rare in this area.

REVIEWS

EDWARD C. BERRY. A Monograph of the Genus Parmelia in North America, North of Mexico. Annals Missouri Botanical Garden **28**: 31–146. February 1941.

It is a pleasure to call the attention of members of the Sullivant Moss Society to this valuable paper. Mr. Berry has examined the Parmelias of nearly all the important lichen herbaria of the country, and his diagnoses are therefore based upon more material than has ever been available to any other American lichenologist. This is the

kind of work I have been urging people to do for over thirty years. Let us hope it will be followed by additional monographs on all the conspicuous genera of our lichens.

To make good keys for the determination of lichens is difficult, but Mr. Berry's keys are above the average, and the general botanist can use them with little trouble. The descriptions are reasonably full, and each includes a careful diagnosis of the sectioned thallus as seen under the microscope; the chemical reactions are also given, as a supplementary aid in the recognition of species.

The introduction gives the history of the genus, a brief account of the ecology of *Parmelia*, and a description of its morphology. With this monograph in hand, one should have little difficulty in naming *Parmeliae* from the United States and Canada.

Three new species are described: *P. erecta* Berry, ranging from North Carolina and Georgia to Arkansas and Texas; *P. hubrichti* Berry, found from Kentucky to Alabama and Texas; and *P. lineola* Berry. The range of this species is given as Montana to Texas, west to Utah and Arizona. It also occurs in California, as attested by a specimen in my herbarium from the hills back of Oakland, and named by Mr. Berry himself.

It is a pity the author did not include citations and synonymy from Tuckerman and from Fink. This would have made his work more intelligible and more usable for the general botanist.

In the list of herbaria cited, from which Mr. Berry studied material, there is a curious error. He has listed the herbarium of Stanford University, when in fact the specimens he examined were from my own private herbarium and not from the University herbarium. It is likewise strange that he failed to cite numerous specimens in the lot sent him, some of which he himself named.

Mr. Berry has given the distribution of each species by states and provinces, and has attempted to give that in the states by counties also. It is to be hoped that the county distribution for other states is more accurate than that for California. Localities within a few miles of Stanford University are placed here and there over the state, from San Bernardino and San Diego Counties, over 500 miles south, to Sonoma County, 75 miles north of Stanford. In a number of instances specimens are listed as "County unknown." A glance at a good atlas, or in the case of Californian specimens a comparison of those listed would have given the county and also have eliminated the contradictions and errors published.

In the discussion of *Parmelia lophyrea* on page 53 one finds "collected only in the Olympic Mountains of Washington." This is followed by three localities, none of them in the Olympic Mountains or even in the Olympic Peninsula. Westport, Chehalis County, is a coastal town on the south side of Gray's Harbor, while Clarke County is on the Columbia River, opposite Portland, Oregon, a long way from the Olympic Mountains. The third locality given, "Northwest

Coast, collected by Nuttall in 1835–36," was also along the Columbia River, near its mouth, as that was where Nuttall did his collecting. Mr. Berry has overlooked two localities in British Columbia, Aleza Lake, and Golden. They were published by Räsänen (Contribution to Lichen Flora of North America," Annals Missouri Botanical Garden, **20**: 13. 1933).

Parmelia olivacea var. *glabra* is said to have been "seen from only a few localities in Southern California." One of the three localities given is Castle Rock. This is in the mountains of the Santa Cruz Peninsula, 400 miles north of southern California. It seems to be impossible for eastern botanists to comprehend that the Santa Cruz Peninsula and Stanford University are not in southern California, or that San Francisco and Los Angeles are over 400 miles apart; Fink's "Lichen Flora" abounds in references to southern California when the real locality is the region about San Francisco Bay.

Parmelia caperata var. *incorrupta* (Moore) Berry is said to be found only in Texas. It also occurs in central California, specimens being in my herbarium.

Students will find Mr. Berry's treatment different from that of Fink. In spite of the three new species, and two considered as *Evernia* by Fink, who also lumps *P. physodes* and *enteromorpha*, Berry has but 56 species, while Fink describes 57, and lists 10 others. It is evident therefore that Mr. Berry's treatment is conservative.

Berry rejects the remarkable *Parmelia arizonica* (Tuck.) Nyl., calling it a *Gyrophora*. This is a conclusion with which few lichen specialists would agree, as it differs too greatly in essentials from the Gyrophoraceae.—ALBERT W. C. T. HERRE, Stanford University, California.

GUNNAR DEGELIUS. Contributions to the Lichen Flora of North America. II. The Lichen Flora of the Great Smoky Mountains. Arkiv för Botanik **30A**: 1–80. *7 figs., 2 pls.* 1941.—This paper represents the first discussion of the lichens of the Great Smoky Mountains National Park. It is chiefly an annotated list of species collected, preceded by a discussion of the area and of the local and general distribution of these lichens. Several of them are indigenous in the tropics and subtropics in contrast to many others which occur far to the north.

The list contains 206 species, a few of which are not determined beyond the genus. Each name is followed by notes on habitat, collection localities and elevations, geography and, where critical, diagnostic characteristics.

The following 15 new species are described: *Staurothele tenuissima* Degel., *Microthelia inops* Degel., *Pleurotrema solivagum* Degel., *Arthonia biseptata* Degel., *Lecidia Degelii* H. Magn., *L. deminutula* H. Magn., *L. gyrodes* H. Magn., *L. subtilis* Degel., *Rhizocarpon intermedium* Degel., *Stereocaulon tennesseense* H. Magn., *Lecanora* (*Aspi-*

cilia) olivaceopallida H. Magn., *L. insignis* Degel., *Parmelia lobulifera* Degel., *Physcia subtilis* Degel., and *Anaptychia squamulosa* Degel. In addition, three new varieties: *Lecidea helvola* (Korb.) Th. Fr. v. *longispora* Degel., *L. olivacea* (Hoffm.) Mass. v. *inspersa* Degel., *Parmelia sorocheila* Vain. v. *catawbiensis* Degel., and one new form: *Umbilicaria papulosa* (Ach.) Nyl. f. *lacerata* Degel., are described. *Pleurotrema solivagum* Degel. represents a family new to North America, the chiefly tropical Paratheliaceae.

Seven species which have not been previously reported from North America are: *Arthopyrenia pinicola, Leptoraphis quercus, Catinaria albocincta, Ochrolechia Yasudae, Arthonia caesia, Parmelia dissecta,* and *Physcia Wainioi. Erioderma* is a genus new to North America; one species is reported, *E. mollissimum.* Six species have not been reported previously from the United States: *Pyrenula bahiana, P. brunnea, Parmelia sorocheila, Physcia melops, Anaptychia corallophora,* and *A. sorediifera.*

Species, of interest from a phyto-geographic standpoint because they have either a very limited or disjunct distribution, include: *Arthopyrenia fallax, Leptoraphis contorta, Opegraphia cinerea, Crocynia neglecta, Thermutis velutina, Pyrenopsis subfuliginea, Leptogium americanum, Pseudocyphellaria Mougeotiana, Nephroma parile, Lecidea granulosa, L. helvola, L. mollis, L. subsimplex, Bacidia chlorantha, B. endocyanea, Rhizocarpon plicatile, Rh. reductum, Cladonia impexa, Cl. mitis, Stereocaulon pileatum, Pertusaria amara, P. laevigata, P. leioterella, Lecanora hypoptoides, L. pinastri, Parmelia Arnoldii, P. cetrarioides, P. revoluta, P, subaurifera, P. trichotera, P. tubulosa, Cetraria ciliaris, Alectoria altaica, A. bicolor,* and *A. sarmentosa.*

It is stated that the lichen flora of the area is poor, but the lichen vegetation is rich. Even so, the author performs a much-needed service in initiating this study of the little-known lichen flora of the southern mountains, which is so ably summarized in this paper.—A. J. SHARP, The University of Tennessee.

NOTE—Dr. Albert W. Herre, of the Natural History Museum, Stanford University, California, has undertaken the preparation of a lichen flora of California. To insure the completeness of this important work, he needs additional material from as many localities as possible, especially from the northern half of the state. Dr. Herre offers to identify unnamed Californian material sent to him, and will return a set of named specimens if desired. It will be to the definite advantage of collectors to coöperate with Dr. Herre if they have Californian lichens.

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NOTES ON MICHIGAN BRYOPHYTES,—IV[1]

WILLIAM CAMPBELL STEERE[2]

Since the appearance of the last installment of this series,[3] the botanical world has suffered a great loss in the death of Professor George E. Nichols.[4] During the summers of 1936, 1937, and 1938, Doctor Nichols made further important studies on the bryophyte flora of Michigan in the region adjacent to the University of Michigan Biological Station, in Emmet, Cheboygan, and especially Presque Isle counties. He also made brief trips to the Upper Peninsula of Michigan in 1937. I have continued bryological explorations in widely separated parts of the state, although with special emphasis on the Douglas Lake region since joining the staff of the Biological Station in 1939.

Doctor Nichols and I planned this to be a joint paper, and a year or so before his death he had turned over to me a number of notes and data for incorporation in it. All his often extensive remarks are set off by quotation marks in the following list, and further identified by his initials in parentheses: (G. E. N.).

The following list includes several species new to the flora of Michigan, but consists in large part of extensions to the geographic range of species which are considered to be rare, unusual, or noteworthy.

[1] Paper from the Department of Botany, the Herbarium, and the Biological Station of the University of Michigan.

[2] I acknowledge here my deep obligation to the Rackham Fund of the University of Michigan for several grants which have made possible not only extensive field studies and visits to several of the major herbaria, but also the publication of this report.

[3] NICHOLS, G. E. AND W. C. STEERE. 1936. Notes on Michigan bryophytes.—III. THE BRYOLOGIST 39: 111–118.

[4] STEERE, W. C. 1939. George Elwood Nichols, 1882–1939. THE BRYOLOGIST 42: 137–142.

The Hepaticae are arranged in accordance with Evans' checklist,[1] whereas the mosses follow Brotherus' treatment,[2] in general.

HEPATICAE

LEPIDOZIACEAE

MICROLEPIDOZIA SETACEA (Web.) Jørg. "Locally abundant in open *Sphagnum* bog bordering Little Lake Sixteen (Cheboygan County). Determined by Dr. A. W. Evans." (G. E. N.)

CALYPOGEIACEAE

*CALYPOGEIA SPHAGNICOLA (Arn. & Pers.) Warnst. & Loeske. "Growing intermixed with *Lepidozia setacea* (Web.) Mitt., *Lophozia Mildeana* (Gottsche) Schiffn. and *Sphagnum* spp. in open bog bordering Little Lake Sixteen (Cheboygan County). Collected by G. E. N. & W. C. S. Identified by Dr. A. W. Evans."

"In this country first recorded from Connecticut by Evans,[3] this species is now known in the east from three other New England states (Maine, New Hampshire and Vermont), from the Adriondacks and Long Island in New York State, and from North Carolina. It has also been collected in the Canadian Rockies and in northern Minnesota. Without much question it is a widely distributed bog species, overlooked by reason of its usually sparse occurrence and the superficial resemblance which it bears to *C. Trichomanis* (L.) Corda. From this and most other species of *Calypogeia,* as Evans (*l. c.*) has pointed out, it is readily distinguished by its small but distinct trigones." (G. E. N.)

CEPHALOZIACEAE

*CEPHALOZIA COMPACTA Warnst. (Krypt. Fl. d. Mark Brandenb. **1**: 217. *3 figs.* 1903). "Along sides of trail in open *Sphagnum* bog bordering Little Lake Sixteen (Cheboygan County). Previously recorded from but one other locality in North America, namely Worcester, Massachusetts (THE BRYOLOGIST **30**: 44. 1927); both specimens identified by Dr. A. W. Evans."

"This apparently unusual form is closely related to *C. connivens* (Dicks.) Spruce from which, according to Warnstorf, it differs in its toothed involucral leaves, its less longly ciliate perianths and its somewhat smaller leaf cells. K. Müller (Die Leberm. Deutschl., Oesterr. u. d. Schweiz. **2**: 36–39. *Fig. 10.* 1916) describes and figures it as a clearly marked species, but subsequently (*l. c.*, p. 774) he alters

[1] EVANS, A. W. 1940. List of Hepaticae found in the United States, Canada, and Arctic America. THE BRYOLOGIST **43**: 133–138.

[2] BROTHERUS, V. F. 1924–1925. Musci. *In* Engler und Prantl, "Die natürlichen Pflanzenfamilien." Ed. II. Vols. 10–11. Leipzig.

[3] EVANS, A. W. 1907. Notes on New England Hepaticae,—V. Rhodora **9**: 56–60, 65–73.

his opinion, remarking that there are all degrees of intergradation between this species and *C. connivens* and quoting C. Jensen to the effect that leaves typical of both species may be found on the same plant. Müller would therefore regard *C. compacta* as being only what is known as a "kleine Art," or species of minor rank, adding that C. Jensen, Loeske, and Schiffner also share this view. Nicholson (Jour. Bot. **63**: 129. 1925) states that he would "be inclined to go one step further and regard *C. compacta* as a variety only of *C. connivens.*" Dr. Evans states that, regardless of what taxonomic rank may be assigned to this plant, he finds very little difficulty in distinguishing it." (G. E. N.)

CEPHALOZIA LOITLESBERGERI Schiffn. "Open *Sphagnum* bog bordering Little Lake Sixteen (Cheboygan County). Determined by Dr. A. W. Evans." (G. E. N.)

CEPHALOZIELLIACEAE

*CEPHALOZIELLA BYSSACEA (Roth) Warnst. On earth in crevice of cliff, trap-rock ridge near Central, Keweenaw County, August, 1937, *A. J. Sharp & W. C. S.* Determined by Dr. A. W. Evans.

JUNGERMANNIACEAE

*LOPHOZIA MILDEANA (Gottsche) Schiffn. "Mixed with other liverworts in open *Sphagnum* bog bordering Little Lake Sixteen (Cheboygan County) and in open sandy bog east of Shingleton (Alger County). Determined by Dr. A. W. Evans." (G. E. N.)

*LEIOCOLEA SCHULTZII (Nees) Jørg. (*Lophozia Schultzii* Schiffn.; *L. Rutheana* Steph.). In open *Sphagnum* bog behind the school and range light at Eagle Harbor, Keweenaw County, September, 1936, *W. C. S.;* in *Thuja* swamp south of Munising Water Works, Alger County, September, 1936, *W. C. S.;* at edge of pool in swamp back of shore of Lake Michigan, under *Myrica Gale,* Cecil Bay, Emmet County, August, 1940, *W. C. S.*

It is surprising that this large and handsome species should have escaped detection in Michigan until now, especially in the Biological Station area. It was long known in North America only from the Yukon, but relatively recently has been discovered in Alberta and in northernmost Minnesota.

ISOPACHES BICRENATUS (Schmid.) Buch (*Lophozia bicrenata* Dumort.). "Damp earth near Lake Superior shore north of Newberry (Luce County)" (G. E. N.); in rock crevices, cliffs near Central, Keweenaw County, September, 1936, *W. C. S.*

ORTHOCAULIS ATTENUATUS (Mart.) Evans (*Lophozia attenuata* Mart.). Among mosses along Carp Creek, just above the Iron

Bridge, north of Burt Lake, Cheboygan County, August, 1940, *W. C. S.*

This is the first collection reported either from the Lower Peninsula or from the Douglas Lake region. It is easily recognized in the field by the strict, attenuated gemmiferous branches which resemble somewhat those of *Dicranum flagellare.*

BARBILOPHOZIA LYCOPODIOIDES (Wallr.) Loeske. On rather dry vertical rock face, extreme summit of Mount Bohemia, Keweenaw County, September, 1936, *W. C. S.*

This is the second collection of *Barbilophozia lycopodioides* reported from Michigan and from Keweenaw County. The first collection was made near Phoenix.[1]

SCAPANIACEAE

SCAPANIA GYMNOSTOMOPHILA Kaal. On rocks, Fort Wilkins, Keweenaw County, September, 1936, *W. C. S.* Determined by Dr. A. W. Evans.

This species has been previously reported only once from Michigan, from Isle Royale.[2]

SCAPANIA IRRIGUA (Nees) Dumort. "Wet ledges along shore of Lake Superior at Sugar Loaf Mountain and on Huron Island. Heretofore unrecorded for the Hurons." (G. E. N.)

FRULLANIACEAE

FRULLANIA BOLANDERI Aust. On birch, mouth of Black River, Gogebic County, September, 1938, *W. C. S.;* on tree, near L'Anse, Baraga County, *W. C. S.;* common on beeches in climax forest, Mackinac Island, Mackinac County, July 16, 1939, *W. C. S. 3016;* on beech, Mount Nebo, Wilderness Park, Emmet County, July 6, 1941, *W. C. S. 3131;* on beech, south of Cross Village, Emmet County, August 7, 1940, *W. C. S. 3078;* common on beeches in forest covering Colonial Point, west side of Burt Lake, Cheboygan County, July, 1940, *W. C. S.*

The intensive search for this interesting species, reported earlier,[3,4] has contined and has brought some very unexpected results. The Baraga and Gogebic county records are quite to be expected, in view of previous collections from Ontonagon, Keweenaw, Houghton, and

[1] EVANS, A. W. AND G. E. NICHOLS. 1935. The liverwort flora of the Upper Michigan Peninsula. THE BRYOLOGIST 38: 81–91.

[2] NICHOLS, G. E. AND W. C. STEERE. 1936. Notes on Michigan Bryophytes.—III. THE BRYOLOGIST 39: 111–118.

[3] STEERE, W. C. 1937. Critical bryophytes from the Keweenaw Peninsula, Michigan. Rhodora 39: 1–14, 33–46.

[4] STEERE, W. C. 1938. Critical bryophytes from the Keweenaw Peninsula, Michigan, II. Annales Bryol. 11: 145–152.

Marquette counties. However, it was a distinct surprise to find it the dominant *Frullania* on beech in the climax forests of Mackinac Island, and still more surprising to find it in similar forests in Emmet and Cheboygan counties. In the fine hardwood forest on Colonial Point, Burt Lake, it is very common and abundant, especially on beeches. It may be recognized at some distance by the very dark color of the large circular colonies on the smooth gray trunks, and by the tendency of the central plants to scale off, leaving only a dark ring of peripheral plants. A close examination, even with the naked eye, reveals the conspicuous, erect, wormlike branches which have lost all but their underleaves. It is obvious from the numerous collections cited here that the species will be found throughout the Upper Peninsula and still farther south in the Lower Peninsula.

FRULLANIA BRITTONIAE Evans. On oak stump, in oak-hickory woods four miles west of Ann Arbor, Washtenaw County, September, 1941, *W. C. S.* This is a southern extension from Gratiot and Montcalm counties.

FRULLANIA INFLATA Gottsche. On trunk of *Acer rubrum* near Lakeland, Livingston County, May, 1938, *W. C. S.* Determined by Dr. A. W. Evans.

This specimen has already been mentioned by Miss Irma Schnooberger[1] who collected the same species at about the same time in Ionia County. These are the only Michigan stations.

FRULLANIA OAKESIANA Aust. On trunk of *Thuja* in dense forest, Fort Wilkins, Keweenaw County, September, 1936, *W. C. S.;* on tree in dense forest just east of L'Anse, Baraga County, September, 1938, *W. C. S.;* on trunk of *Thuja* in deep swamp south of Munising Water Works, Alger County, September, 1936, *W. C. S.*

This small and inconspicuous liverwort has been previously reported from only one station in Michigan, near Jacobsville in Houghton County.

FRULLANIA SELWYNIANA Pears. On *Thuja* in dense swamp south of Munising Water Works, Alger County, September, 1936, *W. C. S.;* on trees in dense forest five miles east of L'Anse, Baraga County, September, 1938, *W. C. S.;* on *Thuja,* in dense swamp at northwest end of Burt Lake, Cheboygan County, July 22, 1940, *W. C. S. 3051.*

These specimens extend the range of the species in Michigan considerably and establish a new record for the Lower Peninsula and for the Michigan Biological Station region. In the field this species

[1] SCHNOOBERGER, IRMA. 1940. Notes on bryophytes of central Michigan. Papers Mich. Acad. Sci., Arts, & Lett. 25(1939): 101–106.

resembles *F. Asagrayana* rather closely, but may be distinguished with the aid of a hand lens by its dentate perichaetial leaves and autoicous inflorescence. As yet, it has been collected in Michigan only on the trunk of *Thuja occidentalis*.

PALLAVICINIACEAE

MOERCKIA FLOTOWIANA (Gottsche) Schiffn. (*Pallavicinia Flotowiana* Lindb.). "Sandy bog along highway east of Shingleton (Alger County). First record for the Upper Peninsula." (G. E. N.)

RICCARDIACEAE

RICCARDIA MULTIFIDA (L.) S. F. Gray. "Springy bank near shore of Lake Superior north of Newberry (Luce County)." (G. E. N.)

REBOULIACEAE

MANNIA RUPESTRIS (Nees) Frye & Clark (*Grimaldia rupestris* Lindb.). On humus, shaded north-facing cliff along Lake Superior, Presque Isle, Marquette County, August, 1936, *W. C. S.*

This species has been reported, in Michigan, only from the Porcupine Mountain region of Ontonagon County.[1]

RICCIACEAE

RICCIOCARPUS NATANS (L.) Corda. In swampy woods, associated with *Cephalanthus*, northwest corner of Black Lake, at outlet of Black River, Cheboygan County, August, 1941, *W. C. S.*

This is the northernmost station known in Michigan for the species, and the first report from the Douglas Lake region.

RICCIA FLUITANS L. In rock pool, Bond Falls, Ontonagon County, September, 1936, *W. C. S.;* mouth of Nigger Creek, Mullet Lake, near Topinabee, Cheboygan County, July 11, 1927, *G. E. N.;* in swampy woods at outlet of Black River, Black Lake, Cheboygan County, July 29, 1941, H. K. Phinney; August, 1941, *W. C. S.*

ANTHOCEROTACEAE

*ANTHOCEROS MACOUNII M. A. Howe. On clay, roadside along Potato River, Ontonagon County, August 21, 1937, *H. S. Conard.*

This interesting northern species, which was first collected near Hull, Quebec, is now known also from Nova Scotia, Maine, New Hampshire, Connecticut, Wisconsin, and Minnesota. Consequently, its discovery in Michigan, although important, is not surprising.

[1] NICHOLS, G. E. AND W. C. STEERE. 1937. Bryophytes of the Porcupine Mountains, Ontonagon County, Michigan. Papers Mich. Acad. Sci., Arts, & Lett. 22(1936): 183–200.

MUSCI

SPHAGNACEAE

SPHAGNUM PLUMULOSUM Röll. "*Sphagnum* bog bordering Little Lake Sixteen (Cheboygan County). Previously known only from Isle Royale." (G. E. N.)

TETRAPHIDACEAE

*TETRODONTIUM BROWNIANUM (Dicks.) Schwaegr. Under overhanging ledges of calcareous sandstone, Tannery Falls, near Munising, Alger County, August 29, 1937, *A. J. Sharp* and *W. C. S.*; July 29, 1939, *W. C. S. 3020a;* July 27, 1940, *W. C. S. 3062.*

This species was one of the most important discoveries made by the Sullivant Moss Society Foray of 1937, since it had not been known previously in Michigan nor elsewhere in the mid-west. It has been collected otherwise in North America in Newfoundland, New England, and northern New York. The peculiar frondiform leaves are abundant on sterile plants growing on vertical rock faces, but fruiting plants were found only attached to the ceiling of an open cave.

FISSIDENTACEAE

FISSIDENS BRYOIDES Hedw. On rotten wood and humus along Big Stone Creek, Wilderness Park, Emmet County, August 12, 1940, *W. C. S. 3049.*

This is a new record for the Douglas Lake region, although the species is common in southern Michigan and has been reported from the Porcupine Mountains in the Upper Peninsula.

FISSIDENS CRISTATUS Wils. This is a common species throughout southern Michigan, and many specimens are in the University Herbarium. Furthermose, many specimens identified as *F. adiantoides* also probably belong here, as a thoroughgoing revision in any herbarium would show.

FISSIDENS OBTUSIFOLIUS Wils. On calcareous gritstone (Marshall Sandstone), Grand Ledge, Ingham County, May 15, 1941, *W. C. S.*

This species is known otherwise in the Lower Peninsula only from Port Austin in Huron County.

FISSIDENS SUBBASILARIS Hedw. On oak stump in hardwoods at Cady's Corners, eight miles south of Ann Arbor, Washtenaw County, 1938, *W. C. S.*

The only other station known for this species in Michigan is in Kalamazoo County.

DITRICHACEAE

DISTICHIUM INCLINATUM (Hedw.) Bry. eur. On rotten log along Big Stone Creek, Wilderness Park, Emmet County, August 12, 1940, *W. C. S. 3129.*

The only other Michigan collection known was made by Dr. G. E. Nichols in Cheboygan County.

SAELANIA GLAUCESCENS (Hedw.) Broth. On rocks, shore of Lake Huron, Port Austin, Huron County, August 16, 1896, *C. A. Davis.*

This species, although common in the Upper Peninsula on rocky shores and reported from the Douglas Lake region, is known in southern Michigan only from the specimen cited here.

DITRICHUM FLEXICAULE (Schwaegr.) Hampe. Not uncommon on shores of Cecil Bay, Emmet County, July, 1940, *W. C. S.*

This is the first known collection from the Lower Peninsula of Michigan.

TREMATODON AMBIGUUS (Hedw.) Hornsch. Very abundant on sandy clay fill, on narrow gauge railroad, just north of Soo Junction, Luce County, July 13, 1940, *H. A. Gleason, Jr., 2703.*

SELIGERIACEAE

SELIGERIA DONIANA (Smith) C. Müll. On vertical and overhanging ledges of limestone near Arch Rock, Mackinac Island, Mackinac County, July 16, 1939, *W. C. S. 3015.*

All earlier reports of this species from Michigan, from Alger,[1] Ontonagon,[2] and Keweenaw[3] counties are based on small and poorly developed specimens of *Gymnostomum calcareum.* The collection cited above apparently represents the only correctly identified Michigan material, other Michigan material distributed under this name is probably erroneously identified and should be reëxamined.

SELIGERIA CAMPYLOPODA Kindb. On erratic limestone boulder, Big Stone Bay, Wilderness Park, Emmet County, July 5, 1941, *W. C. S. 3130.*

This is the third record for Michigan and the second for the Lower Peninsula.

DICRANACEAE

RHABDOWEISIA DENTICULATA (Brid.) Bry. eur. Covering part of the ceiling of Scott's Cave ("Schistostega Cave"), 11 miles west of

[1] STEERE, W. C. 1934. Unreported or otherwise interesting bryophytes from Michigan. THE BRYOLOGIST 37: 57–62.

[2] NICHOLS, G. E. AND W. C. STEERE. 1936. Notes on Michigan bryophytes.—III. THE BRYOLOGIST 39: 111–118.

[3] STEERE, W. C. 1937. Critical bryophytes from the Keweenaw Peninsula, Michigan. Rhodora 39: 1–14, 33–46.

Munising, Alger County, August 29, 1937, *W. C. S.;* July 26, 1941, *W. C. S.;* on calcareous sandstone ledge, Munising Falls, Munising, Alger County, August 29, 1937, *W. C. S.*

This species has been previously reported in Michigan only from Tahquamenon Falls, Luce County.

DICRANELLA SUBULATA (Hedw.) Schimp. On red sandstone in old quarry north of Jacobsville, Houghton County, September 2, 1937, *W. C. S. & A. J. Sharp.*

Otherwise known in Michigan only from Alger County.

DICRANUM BERGERI Bland. "Abundant along roadside north of Newberry (Luce County)." (G. E. N.)

*DICRANUM FULVUM Hook. Common on erratic boulders, wooded morainic hills along Huron River, west of Ann Arbor, Washtenaw County, May, 1936, *W. C. S.*

This species is widespread through the northern United States, and is probably much more common in Michigan than this first record would indicate. The relegation of *Dicranum viride* (Sull.) Lindb. to a variety of this species cannot be maintained, in my opinion, since the two are abundantly distinct in the field, and their geographic ranges do not overlap at all. In the Douglas Lake region, typical *D. viride* often occurs on rocks. A careful study of the two species and their interrelations is now in progress.

PARALEUCOBRYUM LONGIFOLIUM (Hedw.) Loeske. On erratic boulder in forest, Mackinac Island, Mackinac County, August 15, 1941, *W. C. S.*

This seems to be the southernmost station yet known in Michigan for a common northern species, yet it will almost certainly be found south of the Straits of Mackinac, upon search.

POTTIACEAE

GYMNOSTOMUM CALCAREUM Nees & Hornsch. On gritstone cliff, Grand Ledge, Ingham County, May 22, 1937, *W. C. S.;* on rocks below Victoria Dam, Gogebic County, August 17, 1937, *H. S. Conard;* on overhanging rocks, Baltimore Falls, Gogebic County, August 19, 1937, *H. S. Conard;* on exposed limestone, Mill Creek, south of Mackinac City, Cheboygan County, June 30, 1941, *W. C. S. 3135.*

Although this species has been reported in Michigan only from Marquette and Huron Counties,[1,2] it is common and often abundant wherever calcareous rocks are exposed. Until recently, I have con-

[1] NICHOLS, G. E. 1933. Notes on Michigan bryophytes,—II. THE BRYOLOGIST 36: 69–78.

[2] NICHOLS, G. E. 1935. The bryophytes of Michigan, with special reference to the Huron Mountain region. THE BRYOLOGIST 38: 11–19.

sistently misidentified a small form of it as *Seligeria Doniana* and have distributed it under that name from Alger, Ontonagon, and Keweenaw counties.

GYROWEISIA TENUIS (Hedw.) Schimp. On north-facing cliff of red Cambrian sandstone in quarry just north of Jacobsville, Houghton County, September 2, 1937, *W. C. S. & A. J. Sharp.*

Although the existence of this species in North America was long denied, it was unexpectedly discovered in fine fruiting condition.[1] It is otherwise known in North America only from two Canadian stations, one near Lake Winnipeg, Manitoba, and another at Owen Sound, Ontario.

DIDYMODON RECURVIROSTRIS (Hedw.) Jennings. At edge of Portage Creek, near Climax, Kalamazoo County, October, 1928, *H. R. Becker;* locally common on calcareous bank, south shore of Bass Lake, Lakeland, Livingston County, August, 1931, *W. C. S.*

These seem to be the first reports from southern Michigan, although the stations have been known for many years.

*DIDYMODON RIGIDULUS Hedw. On moist trap-rock cliff, Presque Isle, Marquette County, July 28, 1940, *W. C. S. 3057.*

This collection represents the first record for Michigan and also for the midwestern states. The closest station known is on the Bruce Peninsula, Ontario.

*BARBULA CYLINDRICA (Tayl.) Schimp. On calcareous conglomerate cliff, gorge of Manganese River, Keweenaw County, September 1, 1936, *W. C. S.*

The discovery of this typically western species in Keweenaw County presents one more example of the astonishing disjunct distribution already reported.[2, 3] Otherwise, the easternmost known station is in Montana.

BARBULA CONVOLUTA Hedw. "Abundant along roadside north of Newberry (Luce County)" (G. E. N.); not uncommon on clay in the vicinity of Ann Arbor, Washtenaw County, *W. C. S.*

The southern Michigan collections, of long standing, have not been previously reported.

BARBULA FALLAX Hedw. Rocks below Victoria Dam, Gogebic County, August 17, 1937, *H. S. Conard;* on moist shaded ledge,

[1] STEERE, W. C. 1939. *Gyroweisia tenuis* in North America. THE BRYOLOGIST 42: 16–23.

[2] STEERE, W. C. 1937. Critical bryophytes from the Keweenaw Peninsula, Michigan. Rhodora 39: 1–14, 33–46.

[3] STEERE, W. C. 1938. Critical bryophytes from the Keweenaw Peninsula, Michigan, II. Annales Bryol. 11: 145–152.

Tannery Falls, Munising, Alger County, July 27, 1940, *W. C. S. 3065;* Campbell Quarry, Afton, Cheboygan County, August 5, 1940, *W. C. S. 3076;* Bois Blanc Island, Mackinac County, July 8, 1942, *W. C. S.*

Through some oversight this common species, which will probably be found eventually in every county of the state, has been reported only from Washtenaw, Ingham, and Leelanau counties. Consequently, among the collections cited here are the first from the Upper Peninsula and from the Douglas Lake region.

BARBULA UNGUICULATA Hedw. Campbell Quarry, Afton, Cheboygan County, August 5, 1940, *W. C. S.;* Colonial Point, Burt Lake, Cheboygan County, July 31, 1942, *W. C. S.;* Bois Blanc Island, Mackinac County, July 8, 1942, *W. C. S.*

Although careful search will undoubtedly turn up this common moss throughout the state, it has been previously reported neither from the Douglas Lake region nor from the Upper Peninsula, but only from Washtenaw, Kalamazoo, and Leelanau counties.

BARBULA MICHIGANENSIS Steere *in* Grout, Moss Flora of North America 1: 180. 1938. On moist, soft sandstone cliff facing Lake Superior at Miner's Castle, Pictured Rocks, Alger County, August 20, 1935, *G. E. Nichols & W. C. S.;* July, 1939, *W. C. S.;* July, 1940, *W. C. S. 3052.*

Since its original collection in 1935, this moss has been observed each summer and occasionally recollected. It was still abundant in the type locality in 1941, but no new stations have yet been discovered for it.

TORTULA MURALIS Hedw. This species was accidentally credited to Michigan through a misspelling of *T. ruralis.* Although it is obvious from the context that *T. ruralis* was intended, in view of the habitat and the fact that Keweenaw County is at least five hundred miles north of the range of *T. muralis,* it is advisable to correct the regrettable error.

TORTULA OBTUSIFOLIA Schleich. On moist cliff of soft calcareous sandstone, Grand Ledge, Ingham County, May, 1941, *W. C. S.*

This seems to be the southernmost station in Michigan for the species.

GRIMMIACEAE

RHACOMITRIUM SUDETICUM (Funck) Bry. eur. On erratic granitic boulder in coniferous forest, Cecil Bay, Wilderness Park, Emmet County, July 25, 1941, *W. C. S. & William Katz.*

This species has apparently not been collected before either in the Douglas Lake region nor in the Lower Peninsula of Michigan.

EPHEMERACEAE

EPHEMERUM SPINULOSUM Schimp. On bank of Cranberry River, Ontonagon County, August 18, 1937, *H. S. Conard.*

Although Dr. Conard's specimen is not fully mature, its identity is reasonably certain, and extends to a surprising extent the known range of the genus in Michigan, since no members have previously been found in the Upper Peninsula, nor north of Ann Arbor.

BRYACEAE

*ANOMOBRYUM CONCINNATUM (Spruce) Lindb. On moist, soft sandstone cliffs, Miner's Castle, Pictured Rocks, Alger County, August 20, 1935, *W. C. S.;* cliffs at west side of Au Train Point, Alger County, September, 1937, *W. C. S.;* sandstone ledges at very tip of Laughing Whitefish Point, Alger County, August, 28, 1937, *W. C. S.;* on sandstone cliffs north of Bete Grise, Keweenaw County, September, 1936, *W. C. S.;* on shaded rocks below Victoria Dam, Gogebic County, August 17, 1937, *H. S. Conard.*

This species has been collected in New York, Wisconsin and Minnesota, but was long overlooked in Michigan. It seems not to be uncommon on moist sandstone along Lake Superior, and will undoubtedly turn up in many more localities. The Michigan plants are usually short and somewhat scattered, almost never growing in the dense, elongated tufts one sees, for example, at Holzinger's station at Trempealeau Mountain, Wisconsin, which I visited in 1937.

*BRYUM FALLAX Milde. "On north-facing sandstone cliffs along shore of Lake Superior at Pictured Rocks (Alger County). Determined by Dr. A. LeRoy Andrews." (G. E. N.)

BRYUM ULIGINOSUM (Brid.) Bry. eur. "On damp log in cedar swamp along Carp Creek (Cheboygan County). Collected by Dr. F. M. Pagán." (G. E. N.); on cedar stump in swamp, Hammond Bay, Presque Isle County, 1941, *W. C. S.*

This handsome species, which is known otherwise from Kalamazoo and Mecosta counties, is not uncommon along Carp Creek in its headwaters in the Gorge and at the Iron Bridge, and has been collected several times since 1939. It never occurs in any quantity, however, but only as a tuft of a few plants.

MNIACEAE

MNIUM CINCLIDIOIDES (Blytt) Hüben. On soil in black ash swamp near mouth of Carp Creek, Burt Lake, Cheboygan County, August 24, 1942, *G. J. Ikenberry & W. C. S.*

This handsome species is new to the Lower Peninsula and to the Douglas Lake region, although it is not as well developed as farther

north. It is one of the best "finds" of the 1942 Annual Foray of the Sullivant Moss Society.

MNIUM DRUMMONDII Bry. eur. "On clay bank in woods, Porcupine Mountains, G. E. N. & W. C. S. Determined by Dr. A. L. Andrews." (G. E. N.)

MNIUM ROSTRATUM Röhl. A reëxamination of the Michigan material upon which several reports of this species have been based has demonstrated that none of them is correctly identified. Most of the specimens so-named are really *M. affine* or some variation of it. Consequently, this species will have to be deleted, for the present, from the Michigan list.

*MNIUM LYCOPODIODIDES Pal. de Beauv. On steep, shaded, sandy bluff, the Gorge, Cheboygan County, August, 1942, *W. C. S.* Determined by Dr. A. LeRoy Andrews.

This is the first report of the species from Michigan. The material cited here resembles *M. orthorrhynchum* at first sight, but differs especially in the habitat and in the clearly thickened corners of the leaf cells.

MNIUM SUBGLOBOSUM Bry. eur. In *Thuja* swamp at edge of beach pool, Cecil Bay, Emmet County, July 15, 1940, *W. C. S. 3039.*

This is the first record not only for the Douglas Lake region but also for the Lower Peninsula.

CINCLIDIUM STYGIUM Sw. "Common, locally abundant, and frequently fruiting in limey bog near shore of Lake Huron at Hammond Bay (Presque Isle County). Second record for the United States (see note in Nichols and Steere, 1936[1])" (G. E. N.); in small bog behind shore, west of Pointe aux Pins, Bois Blanc Island, Mackinac County, July 8, 1942, *W. C. S.*

This rare species is apparently more common in Michigan than has been recognized, and although it never fruits with the abundance of a *Mnium*, it may be readily recognized in sterile condition since it grows as rather scattered plants at the edge of actually boggy places, whereas the species of *Mnium* with entire leaves are more tufted and are restricted to swamps or woods. It will be found in many more counties of Michigan, on careful search.

MEESIACEAE

MEESEA TRIQUETRA (Hook. & Tayl.) Ångstr. "Open *Sphagnum* bog bordering Little Lake Sixteen (Cheboygan County)" (G. E. N.); in open marshy bog south of Munising Water Works, Alger County, September, 1936, *W. C. S.*

[1] THE BRYOLOGIST 39: 113. 1936.

MEESEA ULIGINOSA Hedw. "Frequent along springy shore of Lake Huron at Hammond Bay (Presque Isle County); collected by Elmer Brown. Also on rotten logs alongside spring in Reese's Bog (Cheboygan County)" (G. E. N.); common along Carp Creek, on wet logs, just north of Burt Lake, Cheboygan County, June 21, 1940, *W. C. S. 3025, 3029;* at edge of shore pool, east side of Duncan Bay, Cheboygan, July 21, 1941, *W. C. S. 3176;* on moist shore of Lake Michigan at Cecil Bay, Emmet County, July 5, 1941, *W. C. S. 3144.*

These records, which cover all three counties of the Biological Station area, are the first for the Lower Peninsula of Michigan.

PALUDELLA SQUARROSA (Hedw.) Brid. In open marsh south of Munising Water Works, Alger County, September, 1936, *W. C. S.*

This beautiful moss is otherwise known in Michigan only from Isle Royale and from Montcalm County in the Lower Peninsula.

CATOSCOPIACEAE

CATOSCOPIUM NIGRITUM (Hedw.) Brid. "Common along springy shore of Lake Huron at Hammond Bay (Presque Isle County). Collected by Elmer Brown" (G. E. N.); in open swale behind shore, east side of Duncan Bay, Cheboygan County, July 21, 1941, *W. C. S. 3177.*

This species seems to be fairly typical of open, moist swales and swamps along the Straits of Mackinac, and will undoubtedly turn up in similar places in the southern part of the Upper Peninsula. It grows in rounded, sand-filled tufts, often where wood has rotted, and usually fruits abundantly.

AULACOMNIACEAE

AULACOMNIUM HETEROSTICHUM (Hedw.) Bry. eur. On soil in Reese's Bog, north shore of Burt Lake, Cheboygan County, July, 1941, *W. C. S.*

This is the first report for the Douglas Lake region and a northern extension of the range of the species in Michigan.

ORTHOTRICHACEAE

ORTHOTRICHUM ELEGANS Hook. & Grev. According to Grout[1] this name should be used for the many specimens reported from Michigan as *O. speciosum* Nees, which is restricted to the Rocky Mountains and westward. However, it will be interesting to see if the true *O. speciosum* turns up in the Keweenaw Peninsula, in view of the many otherwise completely western species known there.

[1] Moss Flora of North America North of México 2: 117. 1935.

ORTHOTRICHUM MACOUNII Aust. On rocky top of ridge, Rock Harbor, Isle Royale, Keweenaw County, August 26, 1937, *H. S. Conard.*

This species has been reported once before[1] from Isle Royale, but is still not known elsewhere in Michigan. Since the geographic range is otherwise distinctly western, and the Isle Royale stations represent a striking disjunction, it is considered worthwhile to cite a second specimen, especially as it may indicate some degree of abundance.

*ORTHOTRICHUM LESCURII Aust. On limestone boulder along Huron River Drive five miles west of Ann Arbor, Washtenaw County, 1939, 1941, *R. J. Lowry & W. C. S.*

This common species on limestone does not seem to have been previously reported from Michigan.

ULOTA LUDWIGII (Brid.) Brid. On aspen, Sugar Loaf Mountain, Marquette County, July, 1941, *W. C. S.;* on aspen, Big Stone Bay, Wilderness Park, Emmet County, August 7, 1942, *W. C. S.;* on birch, Mackinac Island, Mackinac County, August, 1941, *W. C. S.*

This species certainly has a much wider distribution in Michigan than the few specimens and reports would indicate. It usually grows in small, scattered tufts, often among the very abundant *U. crispa,* but is very easily distinguished, even with the naked eye, by the curious capsule.

FONTINALACEAE

*FONTINALIS DISTICHA Hook. & Wils. "In sluggish waters of Pigeon River, near its mouth (Cheboygan County); collected by Dr. J. H. Ehlers and identified by Dr. Winona H. Welch."

"A remarkable extension of range for this southern species, until now known only from Louisiana and Alabama." (G. E. N.)

DICHELYMA PALLESCENS Bry. eur. Forming a ring about the bases of black ash trees, marking the highest spring water level, in swamp at the northwest corner of Black Lake, at the outlet of Black River, Cheboygan County, August, 1941, *W. C. S.*

This is the first collection from the Douglas Lake region.

THELIACEAE

MYURELLA JULACEA (Vill.) Bry. eur. On rotten logs, Big Stone Creek, Wilderness Park, Emmet County, August 12, 1940, *W. C. S. 3098;* on river bank, Lake Huron at Hammond Bay, Presque Isle County, July 17, 1941, *W. C. S. 3149.*

This species, which elsewhere usually grows only on calcareous

[1] THORPE, FRANCES J. AND A. H. POVAH. 1935. The bryophytes of Isle Royale, Lake Superior. THE BRYOLOGIST 38: 32–46.

rock, occurs commonly on soil and humus in the Biological Station area.

MYURELLA CAREYANA Sull. On rotten stump along swampy brook, southwest end of Black Lake, Cheboygan County, July, 1940, *Maria A. R. Harvey;* on shaded limestone, Mill Creek, south of Mackinaw City, Cheboygan County, August 14, 1942, *W. C. S.*

This is the first report for the Biological Station area and also for the Lower Peninsula of Michigan.

LESKEACEAE

LINDBERGIA AUSTINI (Sull.) Broth. On elm trees between Levering and Cross Village, Emmet County, August 7, 1940, *W. C. S. 3084;* on *Thuja,* swamp along Lake Huron at Hammond Bay, Presque Isle County, July 17, 1941, *W. C. S. 3162;* on oak, Cascade Glen, just west of Ann Arbor, Washtenaw County, June 14, 1941, *W. C. S. & R. J. Lowry.*

Although this species has the reputation of being very rare, it is not at all uncommon in Michigan, and will eventually turn up in every county, with careful search. However, it is apparently never abundant in any single colony, but usually occurs as single strands, either isolated or interwoven with other mosses or with hepatics. A careful inspection of herbarium material of *Frullania,* for example, should result in the discovery of new stations for *Lindbergia.* In dry weather it is extremely inconspicuous, but after a rain or heavy dew, the long-pointed, squarrose leaves are unmistakable, even to the naked eye.

*LESKEA GRACILESCENS Hedw. "On roots of ash subject to overflow along St. Joseph's River, St. Joseph (Berrien County). Collected by Mr. E. J. Hill, 1894; specimen in University of Illinois herbarium." (G. E. N.)

THUIDIACEAE

HAPLOHYMENIUM TRISTE (Cesati) Kindb. Shaded nook beside Baltimore Falls, Gogebic County, August 19, 1937, *H. S. Conard.*

An additional record of a species rare in Michigan and elsewhere.

THUIDIUM MINUTULUM (Hedw.) Bry. eur. On rotten wood, bog along Carp Creek, north shore of Burt Lake, Cheboygan County, August 10, 1940, *W. C. S. 3085;* on hummock in wet woods, northwest end of Black Lake, Cheboygan County, July 31, 1941, *W. C. S. 3197.*

This is a new record for the University Biological Station area.

CLIMACIACEAE

CLIMACIUM KINDBERGII (Ren. & Card.) Grout. On wood, Floodwood River, Ontonagon County, August 12, 1937, *H. S. Conard.*

This is the first collection I have seen from the Upper Peninsula.

AMBLYSTEGIACEAE

AMBLYSTEGIUM COMPACTUM (C. Müll.) Aust. "On moist shaded ledge at Tannery Falls (Alger County)." (G. E. N.)

CALLIERGON GIGANTEUM (Schimp.) Kindb. "Springy bank along Lake Superior shore north of Newberry (Luce County). First record for the Upper Peninsula." (G. E. N.)

CALLIERGON STRAMINEUM (Brid.) Kindb. "Open *Sphagnum* bogs north of Newberry (Luce County). First record for the Upper Peninsula, although probably common in similar situations throughout." (G. E. N.) In very wet place, north of Soo Junction, Luce County, July 13, 1940, *H. A. Gleason, Jr., 2747;* in open bog behind range light and school, Eagle Harbor, Keweenaw County, September, 1936, *W. C. S.;* in *Thuja* swamp south of Munising Water Works, Alger County, September, 1937, *W. C. S.*

CRATONEURON COMMUTATUM (Hedw.) Roth. On springy hillside below Arch Rock, Mackinac Island, Mackinac County, July 16, 1939, *W. C. S. 3017.*

This handsome species, which is known elsewhere in Michigan only from Alger and Otsego counties, so much resembles a species of *Drepanocladus* that it is probably often passed over as a member of that polymorphic genus.

DREPANOCLADUS EXANNULATUS (Gümb.) Warnst. "Springy bank along Lake Superior shore north of Newberry (Luce County). First record for the Upper Peninsula." (G. E. N.) In open marsh south of Munising Water Works, Alger County, September, 1936, *W. C. S.*

DREPANOCLADUS VERNICOSUS (Lindb.) Warnst. "Same as preceding." (G. E. N.)

ENTODONTACEAE

ENTODON CLADORRHIZANS (Hedw.) C. Müll. On erratic boulder, Big Stone Bay, Wilderness Park, Emmet County, August 7, 1942, *W. C. S.*

As this species has been reported to be very rare in the Douglas Lake region,[1] it is worthwhile to report an additional specimen from another county. Several new collections have been made in Cheboygan County, also.

ENTODON SEDUCTRIX (Hedw.) C. Müll. On fallen log in swamp along Trout Creek, northeast corner of Douglas Lake, Cheboygan County, July 15, 1939, *W. C. S. 3013a.*

This is the first report from the Biological Station area of a species which is common and abundant in southern Michigan.

[1] NICHOLS, G. E. 1922. The bryophytes of Michigan with particular reference to the Douglas Lake region. THE BRYOLOGIST 25: 41–58.

BRACHYTHECIACEAE

PLATYHYPNIDIUM RUSCIFORME (Neck.) Fleisch. On limestone in Mill Creek, just south of Mackinaw City, Cheboygan County, August 14, 1942, W. C. S.

This is not only the first report for the Douglas Lake region, but also for the Lower Peninsula. Although Fleischer had some reason for erecting a new genus for this and related species, he ignored natural relationships when he allocated it to the Amblystegiaceae. The brachythecioid capsule and rough seta require that it be placed here.

CIRRIPHYLLUM PILIFERUM (Hedw.) Grout. Brookside, one mile west of Rockland, Ontonagon County, August 17, 1937, *H. S. Conard;* on moist ledges, Sugar Loaf Mountain, Marquette County, July 27, 1941, *W. C. S. 3190;* on wet soil and logs, usually among other mosses, along headwaters of Carp Creek in the Gorge, near University Biological Station, August 1939, *Irma Schnooberger;* July 30, 1941, *W. C. S. 3191.*

The specimens cited here add materially to our knowledge of the distribution of this rather rare species in Michigan, since it has been previously reported only from Grand Traverse County.[1] Although it is abundant in the Gorge, within easy walking distance of the Biological Station, it was recognized in the field only in 1941, at the suggestion of Miss Irma Schnooberger, who had discovered one strand of it among a collection of other species from this locality. It commonly grows mixed with *Brachythecium rivulare* and *Bryhnia novae-angliae,* which it resembles in its color and manner of branching. It differs in the very julaceous stems, when wet, and the spreading, filiform apiculus of each leaf, easily seen with a hand lens.

HYPNACEAE

ISOPTERYGIUM DEPLANATUM (Sull.) Mitt. On calcareous sandstone under overhanging ledges, gorge of Tannery Falls, Munising, Alger County, July 27, 1940, *W. C. S. 3069.*

This species has been previously reported from the Upper Peninsula only from Sugar Island, Chippewa County.

HYLOCOMIACEAE

HYLOCOMIUM PYRENAICUM (Spruce) Lindb. Isle Royale, Keweenaw County, August 26, 1937, *H. S. Conard.*

In spite of considerable bryological work done on Isle Royale,

[1] STEERE, W. C. 1933. Notes on the mosses of southern Michigan, II. THE BRYOLOGIST 36: 24.

summarized by Thorpe and Povah,[1] this species was hitherto overlooked.

BUXBAUMIACEAE

BUXBAUMIA APHYLLA Hedw. In old trail, woods at Cecil Bay, Emmet County, July 15, 1940, *W. C. S. 3043;* on humus-filled sand in forest east of Little Lake Sixteen, Presque Isle County, August, 1941, *W. C. S. 3026;* on compact humus behind Pointe aux Pins, Bois Blanc Island, Mackinac County, July 8, 1942, *W. C. S.;* on sandy bank rich in wood, Camp Arbutus, Mayfield, Grand Traverse County, July, 1941, *W. C. S.;* on sand under pines, Muskegon State Park, Muskegon County, May 29, 1937, *H. T. Darlington.*

This species, which is generally considered to be exceptionally rare, was first reported from Michigan by Kauffman. Although its range was later extended to Cheboygan and Alger counties, its reputation for rarity was not lost. During the summers of 1939–1942, however, it was found to be not only widespread but even abundant in the Biological Station region, comprising Cheboygan, Emmet, and Presque Isle counties. It has even been found within the campus area of the Station. Once the characteristic habitat and plant associations have been observed, this moss may be found very easily, as noted in the Pittsburgh region by Eastwood[2] and in Virginia by Fernald.[3]

BUXBAUMIA SUBCYLINDRICA Grout. This species was proposed in 1938 on the basis of Michigan material previously reported[4] as *B. indusiata.* According to its author, this species differs in the shape of the capsule, which lacks stomata, and the fact that the exothecium does not split. Since the type material chosen was Mr. H. R. Becker's collection from near Galesburg, in Kalamazoo County, it is appropriate to call attention to it here.

POLYTRICHACEAE

*ATRICHUM CRISPUM (James) Sull. On rotten log in swamp at Laughing Whitefish Point, Lake Superior, Alger County, August, 1937, *W. C. S.*

Although long since known in Wisconsin and Ontario, this species has not been collected before in Michigan. In confirming the identi-

[1] The bryophytes of Isle Royale, Lake Superior. THE BRYOLOGIST 38: 32–46. 1935.

[2] EASTWOOD, S. K. 1936. Notes on *Buxbaumia aphylla* Linnaeus, Hedwig. THE BRYOLOGIST 39: 127–129.

[3] FERNALD, M. L. 1938. Noteworthy plants of southeastern Virginia. Rhodora 40: 364–424.

[4] NICHOLS, G. E. 1932. Notes on Michigan bryophytes. THE BRYOLOGIST 35: 5–9.

fication, I have had occasion to examine a large series of specimens. *Atrichum crispum* has an interesting and significant distribution in the east,[1] since it is nearly restricted to the Coastal Plain. In the west, however, it has been reported from California and British Columbia. I have not been able to examine all material reported from the west coast, but the several specimens so-named which I have seen have been uniformly some other species, and in my opinion the occurrence of *Atrichum crispum* on the west coast is extremely doubtful. The variety *molle* is likewise open to some question. Frye[2] gives its distribution as "Wisconsin; Florida," a most unnatural geographic range. Holzinger's Wisconsin material (the type) differs sharply from southern material named var. *molle*, and yet all transitions between the variety and the species have been seen.

*ATRICHUM MACMILLANI (Holz.) Frye. On moist soil in beech-maple woods west of Ann Arbor, Washtenaw County, September, 1941, *W. C. S. & R. J. Lowry;* on shaded sandy bank along road to Mud Lake, Cheboygan County, August, 1941, *W. C. S.*

After examining material of *Atrichum Macmillani* from other states, it occurred to me that part of what had been called *A. angustatum* in the field might belcng here. The papillae can be best seen in a section of the leaf, although, as Mr. Robert J. Lowry has pointed out to me, they can also be seen by stripping off the lamellae and examining their upper edges under the microscope. Living material of this species often has a characteristic yellowish or glaucous appearance, due to the abundant papillae. Although only two collections are cited here, it will undoubtedly be found to be as common in Michigan as *A. angustatum*, and it is certain that a reëxamination of herbarium material of the latter species will yield many more stations for *A. Macmillani*.

POLYTRICHUM STRICTUM Banks. Very abundant and commonly fruiting at Mud Lake Bog, west of Whitmore Lake, Washtenaw County, *W. C. S.*

This station has been known for many years, but through some oversight, *Polytrichum strictum* has never been reported from southern Michigan. It has been recorded in the Lower Peninsula only from the Douglas Lake region.

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[1] SHARP, A. J. 1939. Taxonomic and ecological studies of eastern Tennessee bryophytes. Amer. Midl. Nat. 21: 267–354.

[2] Polytrichaceae. *In* A. J. Grout, Moss Flora of North America North of Mexico. 1: 99–128. 1937.

SPORELINGS AND VEGETATIVE REPRODUCTIVE STRUCTURES IN ARCHILEJEUNEA*

MARGARET FULFORD

During a study of the tropical American species of *Archilejeunea*, both sporelings and vegetative reproductive structures were found to occur frequently, but unfortunately the two were never seen in the same species. The pattern of development of the sporeling is similar to that found in several genera of the Lejeuneaceae Holostipae,[1] but the vegetative reproductive structures are of a form not previously reported in the family.

Sporelings.—These occurred in considerable numbers in material of *A. Auberiana* collected at Union Hill, Jamaica (*E. G. Britton 824*) and now in the Herbaria of Yale University and the New York Botanical Garden.

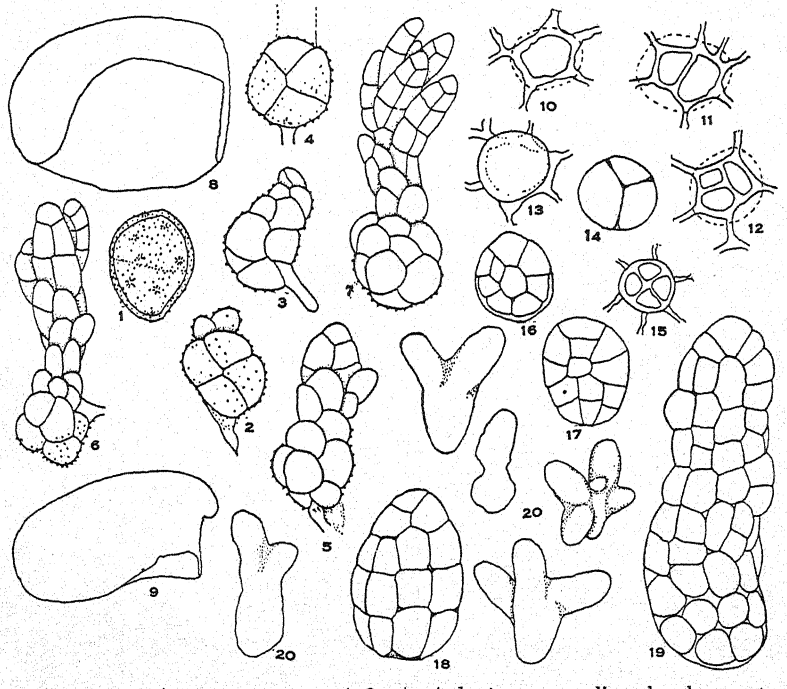
The development follows the *Frullania* type. The spore wall is thick, hyaline, verruculose and with scattered circles of indistinct radiating ridges, and the internal chlorophyll is conspicuous. Almost immediately on separation the spores swell, first becoming rounded and then elongate. The first wall appears to be formed at right angles to the long axis of the cell (fig. 1). Further cell divisions and growth within the much-stretched original exospore cease after four to twelve cells are formed (fig. 4–7). As these cells mature they tend to bulge on the free surface so that the ovoid mass is irregular in outline (fig. 5–7). A rhizoid is usually present (fig. 2–6).

An apical cell with three cutting faces forms at one end of this ovoid mass of cells and the leafy stem is developed through its activities. The first leaves formed are of the primary type, plane, narrowly ovate, and without water sacs (fig. 6 and 7). The number produced on a stem varies but it is usually large, with the internodes very short. No underleaves are associated with these leaves. After a time the larger, bilobed, saccate, juvenile leaves typical of the *Lejeuneaceae* are formed (fig. 8) although leaves similar to the primary type but with few-celled lobules were intermingled with them, so that the transition from the one type to the other was not so direct or so permanent as that observed in some other genera. Underleaves were usually associated with the juvenile leaves. Eventually, through a

* This work was done during a study of tropical American Hepaticae made possible through a John Simon Guggenheim Memorial Fellowship, 1941–1942.

[1] Fulford, M. Development of sporelings in the *Lejeuneaceae*. Bull. Torrey Bot. Club 69: —. *Fig. 1–4.* 1942.

gradual increase in size of successive leaves, the mature type (fig. 9) is developed on these stems.



Figs. 1–20. ARCHILEJEUNEA. 1–9. *A. Auberiana*, sporeling development. 1. A germinating spore, × 400. 2–3. Early stages in the development of the sporeling, × 300. 4. A few-celled 'protonema' with a rhizoid and a leafy shoot (not shown), × 300. 5–7. Older sporelings with a few primary leaves, × 300. 8. A juvenile leaf, × 300. 9. A leaf of a mature plant showing the lobule, × 30. 10–20. *A. porelloides*, vegetative reproductive structure development from cells of the leaf. 10–12. Dedifferentiated cells of the leaf; 11 and 12 with supplementary divisions, ventral surface, × 300. 13–15. Early stages of development of the vegetative reproductive structure from the leaf cell, dorsal surface, × 300. 16–19. More advanced stages of development, × 300. 20. Irregularly formed and branched vegetative reproductive structures, × 100.

Vegetative Reproductive Structures.—Vegetative reproductive structures from individual cells of the leaf were found in *A. porelloides* from Honduras, British Guiana, Brasil and Ecuador and in *A.* **fuscescens** (Hampe) (*Marchesinia fuscescens* Stephani[1]), from Ecuador. They are alike in the two species. The pattern of development of these structures suggests that described for the adventitious shoots in

[1] Spec. Hep. 5: 148. 1912.

Bazzania.[1] They arise on the dorsal surface of the leaf and occasionally on the underleaf. They were most abundant in the upper and outer half of the leaf and seemed never to arise in cells of the central and basal portions or in the lower part which was covered by the leaf just below.

The cell which will give rise to one of these structures dedifferentiates, that is, the cell content becomes dense and granular and the nucleus enlarges and is conspicuous. Very often one, two, three or four walls are formed within one of these cells (fig. 10–12). These walls are frequently much thinner than the boundary walls of the original cell. A cell with granular content bulges on the dorsal side of the leaf (fig. 13). In some instances this protuberance was observed over a one-, two, three-, or four-celled complex but the relationship here could not be satisfactorily demonstrated. In it a wall is laid down at right angles to the surface of the leaf so that two cells are formed. These also divide by walls at right angles to the surface of the leaf and through their narrow diameter, to form a four-celled body (fig. 13–15). Whether a wall separates these cells from the leaf cell or cells is not known. Continued cell divisions in both the longitudinal and transverse planes, together with growth, result in a multicellular ovoid structure suggestive of that formed by the germination of the spore (fig. 16).

These ovoid masses of cells continue to grow indefinitely, and form thick cylindrical structures without leaves (fig. 17–20). The largest were 0.32 mm. long and 0.07 mm. broad at the base, and narrowed a little to the apex. They are usually straight (fig. 19) but stems with one to several branches are not uncommon; some also showed evidence of interrupted growth, particularly through the presence of a constricted area some distance from the base, and above it a return to the original diameter (see fig. 20). No leaves of any sort were present.

These structures may be used as a diagnostic character of the genus, since similar structures have never been reported as occurring in any other genera of the American *Lejeuneaceae*, and are particularly helpful in working with sterile material.

I wish to express my appreciation to the Botany Department of Yale University and to the New York Botanical Garden for providing working facilities during this study.

UNIVERSITY OF CINCINNATI, CINCINNATI, OHIO.

[1] Fulford, M. Amer. Midland Nat. 17: 385–424. *fig. 1–12*. 1936.

TAXONOMIC NOTES

II. ANOTHER NATURAL HYBRID IN THE FUNARIACEAE

A. LEROY ANDREWS

From reclaimed soil dredged from the inlet of Cayuga Lake in Ithaca, N. Y., now the site of an airfield, I described in 1918[1] a hybrid moss, *Physcomitrella*[2] *patens* ♀ by *Physcomitrium turbinatum* ♂. In further material which I collected in November 1913 I find another hybrid with *Physcomitrium immersum* Sulliv., the ♂ parent of which was apparently also *P. turbinatum*. The features which at first sight distinguish it from *P. immersum*, amongst which and on the gametophyte of which it was growing, are the capsule slightly emergent rather than immersed, often somewhat turbinate when dry and not yet mature in November, *P. turbinatum* maturing in the following spring as compared with *P. immersum* in the fall.

Physcomitrium immersum ♀ × **Physcomitrium turbinatum** ♂. Gametophyte that of *P. immersum*, with characteristic fruiting specimens of which it was growing. Capsule barely emergent above leaves on very short seta, about 1.5 mm. in length, capsule broadly pyriform, about 1 × 0.75 mm., sometimes turbinate when dry, operculum constituting hardly a quarter of the total length, calyptra not as persistent as in *P. immersum* and no longer present on my specimens. Operculum mamillate with short, broad and blunt apex which shows rather large thin-walled cells a little longer than wide, the rest of operculum with smaller and more nearly isodiametric cells. Exothecial cells of urn of capsule moderately thick-walled, averaging about twice as long as wide, except at mouth where 3 or 4 rows are slightly transversely elongated and 1 or 2 rows are very small, constituting the (persistent) "annulus." Stomata in neck of capsule, tending to be in 2 rows, darker in color, not immersed. Spores (not fully matured) brownish green, rough, around 20 μ or less in diameter.

Without entering into a detailed comparison with the sporophytes of the parent species, from their descriptions by Grout[3] and the earlier ones of Mrs. Britton in her important article on *Physcomitrium*[4] the intermediate status of the above described capsule in all respects

[1] Torreya **18**: 52*ff*.

[2] That I employ the generic name *Physcomitrella* as a citation from my earlier paper is not to be taken as evidence that I disagree with Grout (Moss Flora of North America North of Mexico **2**: 73. 1935, following Lindberg, 1864), who would combine this genus with *Aphanorhegma*. There is of course no good generic line to be drawn between the two. In fact in my earlier article (p. 54) I had already suggested that both could without difficulty be united with *Physcomitrium*. In view of the almost imperceptible transitions between the various genera included in the *Funariaceae* and the fact that they hybridize with one another all the way from *Physcomitrella* to *Funaria* one could unite all into a single genus *Funaria* without in any way doing violence to their natural relationships.

[3] Op. cit. **2**: 74 *ff*. 1935.

[4] Bull. Torr. Bot. Club **91**: 190 *ff*. 1894.

except the smaller (unripe) spores may be easily seen. The number of hybrid capsules are relatively few among the great number of normal ones of *P. immersum*. The locality from which the collection was made was near the edge of the newly dredged soil.

One might easily raise the question whether *P. Hookeri* Hpe., which is frequently growing with *P. turbinatum*, as noted by Grout[1] and already by Lesquereux and James,[2] does not represent the reciprocal cross of the same two species, but its gametophyte is clearly not that of *P. turbinatum* and its sporophyte has also abundantly distinctive characters of its own. My collection of good specimens of this species made in the same locality southwest of Cayuga Lake in May 1914 (also growing with *P. turbinatum*) was noted in my article of 1918, but attention should again be called to it as it is not included in the distribution given by Grout (p. 77) and is apparently the easternmost station for the species, in fact the only one from the eastern (coastal) states. The Cornell Herbarium contains another later collection of *P. Hookeri* (leg. W. E. Manning, 1925) from the other (east) side of the inlet of Cayuga Lake (Renwick), evidently taken from later dredged new soil, where it likewise grew with *P. turbinatum*.

In view of the easy hybridization of various species of the *Funariaceae* and the fact that the species can be grown without difficulty on pots of soil in greenhouses, or doubtless without the necessity of a greenhouse, they furnish a rich field for experiment and investigation, one that has been exploited for the European species in the epochal work of F. von Wettstein,[3] who has not yet however, so far as I am aware, given full publication to the results of cytological study of his material. As American species in this family are to a considerable degree different from the European ones there is here a broad field for American research on very fundamental questions. The ease with which diploid forms can be cultured from regeneration of sporophyte tissue (Marchal method), followed by repeated regeneration and by cross-fertilization with the haploid form, permits the raising of a variety of heteroploid forms up as high as the material will permit.[4] This fact was also exploited by Wettstein in the *Funariaceae*, who in addition investigated the genetic operation of the Mendelian principles

[1] P. 77.

[2] Manual of Mosses of North America 198. 1884.

[3] Particularly in Morphologie und Physiologie des Formwechsels der Moose auf genetischer Grundlage 2. 1928; see also by the same author: Verdoorn, Manual of Bryology 233 *ff.* 1932.

[4] Wettstein (1932), p. 249, reports reaching 16 times the normal number of chromosomes.

by crosses made between different races of *Funaria hygrometrica* and theorized on the part played in heredity by the plasma in comparison with that played by the genes.

That some of these complicated processes achieved by manipulation under culture may occasionally take place spontaneously in nature is conceivable enough and may in slight degree account for a few of the irregularities that trouble the taxonomist, but it remains probable that a great part of our unnecessary species rest rather merely upon different habitat conditions or often solely on the fertile imagination and careless technique of many of our species-makers.

ITHACA, N. Y.

REVIEW

CLARA J. CHAPMAN AND ETHEL I. SANBORN. Moss Flora of the Willamette Valley, Oregon. Oregon State Monographs, Studies in Botany **4**: 1–72. *5 plates*. Corvallis, 1941. ($0.50).—In their effort to simplify the study and identification of the mosses of a limited area of Oregon—the Willamette Valley—the authors have succeeded admirably. This well-printed booklet furnishes, at last, a usable manual of the mosses not only of the Willamette Valley, but also of other, similar regions of the Pacific Northwest.

The authors describe adequately 114 species and cite the specific geographic localities from which each one is known. The text includes keys to species and genera, and provides, in addition, separate keys to the 21 families and 60 genera treated. One of the most valuable contributions of this manual is the set of five plates of original drawings which illustrate the diagnostic features of 24 species. The well-selected glossary will be especially useful to beginners.

The scarcity of typographic errors speaks for the careful proof-reading by the authors. My criticisms are so much a matter of personal opinion, and so minor, that I hesitate to set them forth. However, the use of a comma before the citation of a collector's name in parentheses is hardly a standard practice. The lettering used on the plates is so large that it mars their appearance. Finally, a short note or observation pointing out the individual or unique features of each species would have made the technical descriptions much more intelligible to the uncritical amateur. However, the authors have produced a handbook of much merit, in spite of these minor criticisms, and I recommend it heartily to everyone interested in mosses. It is to be hoped that this booklet will serve two purposes: to interest the botanists of the Willamette Valley in mosses, and to stimulate the preparation and publication of other geographically restricted manuals.—W. C. S.

SEVERIN RAPP; AS I REMEMBER HIM

Severin Rapp was a worthy successor to C. C. Frost of Brattleboro, Vermont, who was also a shoemaker, collaborator with the aristocratic Tuckerman of Amherst College, and to C. F. Austin, the country schoolmaster of Closter, New Jersey, whose equal as a collector of bryophytes has not yet been seen in this country.

Mr. Rapp was a German immigrant without any special scientific training, but endowed with a keen eye and a critical mind.

Sometime around 1910 I began correspondence with him and he sent me money with which to purchase a second-hand microscope at a reduced price. I did not find a suitable one at a satisfactory price for a considerable time. In fact, Mr. Rapp decided for a time that I intended to keep his money.

I first visited him in April, 1926, when he took me to many of his choice collecting localities. His living quarters were in an old, dilapidated building, part of which he rented as a butcher shop. His sleeping quarters were in the second story, which I was not invited to inspect. His work shop and laboratory contained a greater conglomeration than I have ever seen elsewhere in one room; shoes for repair, shoemaker's tools, canned food for himself, food for his parrot, books, mosses, microscope, medicines and other articles too numerous to mention. He took his dinners at a cheap hotel where the food was plain but good, for we sampled it. I think he got his other meals himself.

His best clothes appeared to be a new clean workman's outfit of cotton goods. I thought at first that he was pitifully poor, but as we went collecting on April 30th, he remarked that he could go with me then, but that the next day he would have to collect his rents!

Twice after this I stopped at Sanford to go collecting with him. The last time was about five years ago, when he undertook to show me where he had collected *Macromitrium rhabdocarpum*. We searched carefully through a corner of woods without results. As a violent thunderstorm was coming up we rushed out to find my auto, but Mr. Rapp went in exactly the opposite direction from its location. Evidently his mind had lost some of its keenness. Of late years he apparently was unable to do much botanical work.

Mr. Rapp contributed several numbers to my exsiccati. As a collector of all groups of plants he found several species new to Florida and some new to science. His residence for so long a time in

one locality enabled him to make many finds overlooked by that prince of botanical explorers, the late John K. Small.—A. J. GROUT.

SOME NOTEWORTHY LICHENS FROM FLORIDA

ALBERT W. C. T. HERRE

The late Severin Rapp, of Sanford, Florida, was an enthusiastic collector and student of lichens, and added largely to the knowledge of the lichen flora of his adopted state. For several years he had been sending me rarities, and also puzzling species which he was unable to determine. I was about to make a full report upon them at the time of his death. As several were little known, and the first five are new to the United States, it seems worth while to make a record of them.

TRYPETHELIACEAE

MELANOTHECA WRIGHTI Müll.-Arg. On *Acer* sp., at Sanford and at Melonville. A Cuban lichen new to the United States. Spores 13.5–18.6 μ by 28 to 45 μ; spores larger than given by Müller of Argau, but this species without question.

TRYPETHELIUM OCHROLEUCUM Nylander. A tropical species of wide distribution; new to the United States. On *Quercus* sp., at Sanford. Spores quadrilocular, 7 to 10 μ by 19 to 27 μ.

BOTTARIA ENDOLEUCA (Fée) Müll. Arg. Thallus greenish and off-color, but not to be placed elsewhere. On *Tilia* sp., at Monroe. Spores mostly 3-septate but also 5 and 7-septate, multilocular, measuring 16 to 25 μ by 38 to 50 μ. A lichen of the American tropics, new to the United States.

LAURERA VARIA (Fée) A. Zahlbruckner. Specimens from Sanford, determined by Dr. Zahlbruckner. A lichen of the American tropics, new to the United States.

ASTROTHELIACEAE

ASTROTHELIUM OCHROTHELIZUM (Nyl.) Müll. Arg. On *Nyssa* sp., at Oviedo; determined by Dr. A. Zahlbruckner. Previously known from Singapore and Cuba.

DIPLOSCHISTACEAE

CONOTREMA ALBONIGRUM A. Zahlbruckner. Monroe; determined by Dr. Zahlbruckner and described (Ann. Mycologici **33**: 42. 1935) too late to be included in Fink's Manual.

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New scientific names are printed in bold-face type

Illustrations are indicated by an asterisk (*)